

AGENDA
CALIFORNIA TRAFFIC CONTROL DEVICES COMMITTEE (CTCDC)
February 2nd, 2011 Meeting (Start Time 9 a.m.)
1000 Ulatis Drive (Ulatis Community Center)
City of Vacaville, CA 95687

Organization Items

1 Introduction

2 Approval of Minutes (September 2, 2010 Meetings)

3 Public Comments

At this time, members of the public may comment on any item not appearing on the agenda. Matters presented under this item cannot be discussed or acted upon by the Committee at this time. For items appearing on the agenda, the public is invited to make comments at the time the item is considered by the Committee. Any person addressing the Committee will be limited to a maximum of five (5) minutes so that all interested parties have an opportunity to speak. When addressing Committee, please state your name, address, and business or organization you are representing for the record.

4 Chairman's Comments

Agenda Items

5 Public Hearing

Prior to adopting rules and regulations prescribing uniform standards and specifications for all official traffic control devices placed pursuant to Section 21400 of the California Vehicle Code (CVC), the Department of Transportation is required to consult with local agencies and hold public hearings.

11-1	Adoption of National MUTCD 2009 Parts 1, 5, 7 and 9 into the California MUTCD to be called CA MUTCD 2011	(introduction) 6 (Henley)
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(Note: The above Item will be addressed last on the Agenda)

11-2	Proposal to adopt revised text, tables, and figures in Part 6 of the CA MUTCD 2010 – Submitted by LA DOT	(Introduction) 7-35 (Fisher)
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6 Request for Experimentation

10-10	Request for Permission to Experiment with modified SPEED HUMP (W17-1) Signs - (Requested by the City of Stockton)	(Continued) 36-49 (Knowles)
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11-3	Request to Experiment with Buffered Bicycle Lanes on 2 nd St. between Bayshore Dr. & PCH in Naples (Requested by the City of Long Beach)	(Introduction) 50-63 (Fisher)
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11-4	Request for Permission to Experiment with Rectangular Rapid Flashing Beacon – (Requested by the City of Santa Monica)	(Introduction) 64-73 (Fisher)
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11-5	Request to Experiment with New Bicycle Pavement Marking (Requested by the City of Palo Alto)	(Introduction) 74-77 (Knowles)
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- 08-20 Final Report on Experimentation with Flashing Yellow Arrow for (Continued) 78-83
Permissive Right Turn Movement – (Final Report by Marin Co.) (Mansourian)

7 Information Items

- 10-11 Status of speed limit procedures changes in July 2009 (Continued) 84
(Summary of the data collected for the E&TS's performed(Henley)
between July 2009 and July 2010)

The CA MUTCD 2010 has been posted on the following website:

<http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/index.htm>

- 10-2 Proposal to amend existing typical applications and adopt new TA's for accommodating bicyclists in TTC zones and to Revise CA MUTCD Sections 6D.101(CA) and 6G.05 and added a new Table 6H-1(CA).
Status: The policy is still under review.

8 Next Meeting

9 Adjourn

ITEM UNDER EXPERIMENTATION

- 06-2 Experiment with Colored Bike Lane (Wong)
(Proposed by the City of San Francisco)
Status: No Update received before this meeting.
Experiment with Colored Bike Lane: The first test location and material was installed in May 2010. Data collection is continuing. The next two locations have been identified, before data collection is occurring, and the variable is scheduled to be installed by the end of September. All data collection and a subsequent analysis will now be performed by the City.
- The revised schedule is as follows:
Winter 2009/2010 - Investigate Materials Spring 2010 thru Spring 2011 - Collect Before Data
Spring 2010 thru Spring 2011 - Install Variable at Test Locations Spring/Summer 2011 -
Collect After Data Fall/Winter 2011 - Analyze Data and Prepare Final Report
- 07-19 Wildlife Corridor Signage (Babico)
(Proposed by the County of San Bernardino)
Status: The applicant still searching for someone to do study for the Federal Highway folks. The type of study that they requested would cost many thousands of dollars. Applicant is looking for a college student that could make the study part of his curriculum.
- 08-7 Request for Experimentation with new Warning Sign for Bicyclists (Wong)
(Proposed by the City/Co of San Francisco)
Status: No change since their last report. The City and County of San Francisco would like to bring this experiment to a close and therefore will analyze collision data collected before and after the installation of this experimental warning sign and submit the results to the Committee within the next 12 months for its evaluation.
- 08-21 Proposal to Experiment with Regulatory Sign "BIKES IN LANE" with (Henley)
Bicycle Symbol (Originally submitted as "Bike May Use Full Lane")
Status: No New update. Caltrans District 5 still looking for funding for the human factors study. The signs have been well received and there are no negative issues to report at this time. State collision data is not yet available, however, collision data obtained from the City of Santa Cruz up to 09/01/09, shows that there have been 3 bike related collisions since the signs went up, 5 in the year previous, and 7 in the year prior to that.

09-9 Request to Experiment with Steady Red Stop Line Light

(Fisher)

Status: See below:

CTCDC STATUS OF EXPERIMENT

Date: December 20, 2010

Item: 09-09

Experiment: Steady Red Stop Lights

Sponsor: City of Los Angeles Department of Transportation (LADOT)

Supporting Agency and Contact: LA County Metropolitan Transportation Authority (Metro), Abdul Zhobi (213) 922-2114

Next Appearance Before the CTCDC: _____

Milestones: Started "before project" data collection in November 2009

Started construction in **February 2010**

Finished construction in **May 2010**

Start "after project" data collection in **March 2011**

Finish all data collection in **December 2011**

Finish final report **March 2012**

Status: The construction of the in-pavement steady red stop lights at the two locations (one at Metro Orange Line crossing at Woodman Avenue and the other at Metro Blue Line crossing at Los Angeles Street) has been completed. Some lights have been out for unknown reasons. We are working with the vendor to get them replaced after the new year. The "after" data collection is postponed to March 2011.

Applicant's Signature: _____

Applicant's Name: Kang Hu, PE, PTOE

Address: 100 S. Main Street, Los Angeles, CA 90012

Phone: 213-972-8627

FAX: 213-972-8610

- 09-13 Experiment Request for the USAGE OF “HOV” IN LIEU OF
“CARPOOL” Signage Related to the Los Angeles EXPRESS LANES (Henley)
Status: The project is in planning stage
- 09-14 Experiment request for the Usage of “TRANSIT LANE” in lieu of (Henley)
“CARPOOL” Signage
Status: The project is in planning stage
- 09-21 Request for Permission to Experiment with Separated/Protected Bikeway (Fisher)
on the Left Side of Two One-Way Streets in the City of Long Beach (Rte 9-112E)
Status: No new update. See under “Status Report – Ongoing Experiments” on the following
website:
<http://www.dot.ca.gov/hq/traffops/signtech/newtech/index.htm>
- 10-3 Experiment with Second Train Warning Sign “Additional Train May (Fisher)
Approach” with a Symbol Sign (Submitted by City of Riverside)
Status: No update.

Pending Items for Caltrans Action

- 07-1 Proposal to revise the sizes for the Supplemental School Plaques (S4-3, W16-7p and W16-9p)
Status: No update received.

11-1 Adoption of National MUTCD 2009 Parts 1, 5, 7 and 9 into the California MUTCD to be called CA MUTCD 2011

Recommendation: Caltrans requests CTCDC to make recommendation to adopt Parts 1, 5, 7 and 9 of the National MUTCD 2009 as posted on the website.

Requesting Agency and Sponsor: Caltrans

Background: Parts 1, 5, 7 and 9 were discussed in the CTCDC Workshop held on April 14, 2010 in Sacramento and they were all posted on the website (http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2011_draftrevisions.htm) by November 8, 2010 for comments. Comments received on these parts have been posted on the following website:

http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2011_draftrevisions.htm

The public agencies and the general public still have time to provide comments during the public comments period which is open until January 24, 2011. All submitted comments on these parts will be discussed during the CTCDC meeting and necessary actions will be taken by the Committee before making final recommendations to Caltrans.

Remaining Parts 2, 3, 4, 6, and 8 are targeted to be posted on the website by February 28, 2011 and their comments period will be open through April 30th, 2011. These Parts will be discussed in the future CTCDC meeting and Caltrans will request CTCDC for recommendations on these parts during that meeting. If time permits during the February meeting, any comments received on Parts 2, 3, 4, 6 and 8 will be discussed, but no action will be taken until the next meeting.

11-2 Proposal to adopt revised Text, Tables, and Figures in Part 6 of the CA MUTCD 2010

RITA L. ROBINSON
GENERAL MANAGER

CITY OF LOS ANGELES
CALIFORNIA



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November 23, 2010

Mr. Devinder Singh
Executive Secretary, CTCDC
Caltrans
P.O. Box 942874
Sacramento, CA 94274-0001

Dear Mr. Singh:

Enclosed are proposed revisions relating to Part 6. They are submitted by the City of Los Angeles and I sponsor the proposed revisions.

I request that these items be scheduled for the February 2, 2011 meeting of the CTCDC and that approved revisions be incorporated into the 2011 California MUTCD.

John E. Fisher, P.E., PTOE
Assistant General Manager

JEF:je

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Enclosures

Recommendation

That the CTCDC adopt revisions to text, tables, and figures in Part 6 for incorporation into the 2011 California MUTCD, as summarized in Table 1 and as shown in the enclosures.

Requesting Agency

City of Los Angeles Department of Transportation (John E. Fisher)

Sponsor

John E. Fisher, CTCDC Chair representing the League of California Cities, Southern counties

Background

The Work Area Traffic Control Handbook, commonly known as the WATCH manual, and its predecessors have been in existence for nearly 60 years. The 2009 version is its eleventh edition. The WATCH manual “..... is intended to serve as a standard for control of traffic in work areas in public streets by cities, counties, and other agencies responsible for such work”

The WATCH manual has been used by local jurisdictions to identify work area traffic controls for short term detours that might not be adequately illustrated in the California MUTCD. In recent years, the differences between the WATCH manual and California MUTCD have narrowed. The WATCH manual has no legal standing, but it is still valued by local jurisdictions.

I convened a meeting of WATCH manual users and some WATCH Committee members to identify areas where it was believed that the California MUTCD could be improved. The meeting included among others: David Royer, who teaches “Traffic Control for Safe Work Zones” for the University of California, Berkeley Institute for Transportation Studies; and Don Schima who represents the Los Angeles Department of Transportation (LADOT) on the WATCH Committee.

As a result of those discussions, a summary of the proposed revisions is shown in Table 1 below. In addition, the proposed revised pages are enclosed.

Table 1: Summary of Proposed Revisions to Part 6

Number	Reference	Revision	Reason
1	Section 6F.58, Support	Editorial – Add the word “channelizers” as a channelizing device	Corrects a previous oversight
2	Section 6F.59, Standard	a. Eliminate 18” cone; b. Require 28” minimum height for lower speed streets; c. Require 36” minimum height for higher speed streets	18” cones lack retro-reflectivity and therefore are not practical at night. 28” and higher cones have become the <u>de facto</u> standard and represent best practices.
3	Section 6F.60	Similar to 2., but applicable to tubular markers	18” tubular markers have minimal target value. 42” tubular markers are the only size available, have become the <u>de facto</u> standard and represent best practices.
4	Section 6F.101(CA) Standard	Add the spacing requirement, as shown in Table 6F-102(CA)	Corrects a previous oversight.

Table 1: Summary of Proposed Revisions to Part 6 (Continued)

Number	Reference	Revision	Reason
5	Table 6C-1	Apply speeds for each roadway type	Promotes greater uniformity by agencies and contractors, due to specificity
6	Figure 6F-6	Editorial – Show the appropriate uses	Incorporates info in Section 6F.56, so that the Figure can be more useful
7	Figure 6F-7	See Numbers 4 and 5	Figure 6F-7 would be consistent with revisions to Sections 6F.59 and 6F.60.
8	Figure 6F-101 (CA)	Restore the C20(CA) sign, indicating how the C20A(CA) and C20B(CA) sign panels can be applied.	The C20(CA) sign is mentioned in Section 6F.21, but is inadvertently, missing from Figure 6F-101(CA)
9	Figure 6F-102 (CA)	Editorial – The height is clarified	The height requirement would be more consistent with text in Section 6F.101 (CA).
10	Figure 6H-18, possibly Figure 6H-18A(CA)	Revise figure to show flagger.	A flagger is needed when traffic is directed to the left of a striped center line
11	New Figure, possibly Figure 6H-18B(CA)	Similar to the above figure, but shows 2-way traffic coned around the obstruction	It should be included since this situation is common in urban areas.
12	Figure 6H-21	Revise figure to show on Arrow Panel, instead of a Flag Tree	Arrow Panels are recommended (Guidance) for lane closures in Section 6F.56.
13	Figure 6H-22, possibly Figure 6H-22A(CA)	Revise figure to show pavement markings as per Figure 3B-12(CA) Sheet 3 of 3	Trap lanes do not provide orderly operation without the lane drop pavement markings. Section 3B.09 mandates these markings as a Standard.
14	New Figure, possibly Figure 6H-22B(CA)	Similar to the above figure, but with the option to close the lane, instead of entrapping it with lane drop reduction markings	Figure 6H-22 is not effective, without lane reduction markings or a lane closure. The new Figure illustrates an option that is used frequently in urban areas.
15	Figures 6H-23, 24, 30, 31, 32	Revise to delete the word “Optional” below the Arrow Panels	Arrow Panels are a Guidance requirement, not an Option in Section 6F.56 when a lane is closed.
16	Figure 6H-24 (CA)	Revise to show a tapered transition in advance of the intersection	An abrupt, full-lane transition through the intersection is sub-standard.
17	Figure 6H-25	Revise figure to: 1) Show an Arrow Panel instead of a Flag tree; and 2) Channelize thru traffic, to the thru lane to the right, not entrap it to the left turn lane.	Arrow Panels are required for lane closures in Section 6F.56. Also, thru traffic should be channelized to the available thru lane.

18	New Figure, possibly Figure 6H-46B(CA). Possibly re-number 6H-46 to 6H-46A (CA)	Shows a flagger for a lane reduction near a rail crossing, for queue control. Show the correct flagger symbol in Figure 6H-46A(CA).	Due to the increased probability of queuing across the tracks with a lane reduction, a flagger is needed, as per Section 8A.08 of the 2009 MUTCD.
19	New Figure, possibly Figure 6H-46C(CA)	Shows a flagger for a lane reduction that could impact turning from a side street near a rail crossing	Same reason as above.

Section 6F.58 Channelizing Devices

Standard:

Designs of various channelizing devices shall be as shown in Figure 6F-7.

Support:

The function of channelizing devices is to warn road users of conditions created by work activities in or near the roadway and to guide road users. Channelizing devices include cones, tubular markers, channelizers, vertical panels, drums, barricades, and temporary raised islands.

Channelizing devices provide for smooth and gradual vehicular traffic flow from one lane to another, onto a bypass or detour, or into a narrower traveled way. They are also used to separate vehicular traffic from the work space, pavement drop-offs, pedestrian or shared-use paths, or opposing directions of vehicular traffic.

Standard:

Devices used to channelize pedestrians shall be detectable to users of long canes and visible to persons having low vision.

Where barricades are used to channelize pedestrians, there shall be continuous detectable bottom and top rails with no gaps between individual barricades to be detectable to users of long canes. The bottom of the bottom rail shall be no higher than 150 mm (6 in) above the ground surface. The top of the top rail shall be no lower than 900 mm (36 in) above the ground surface.

Option:

A gap not exceeding 150 mm (6 in) between the bottom rail and the ground surface may be used to facilitate drainage.

Standard:

If drums, cones, or tubular markers are used to channelize pedestrians, they shall be located such that there are no gaps between the bases of the devices, in order to create a continuous bottom, and the height of each individual drum, cone, or tubular marker shall be no less than 900 mm (36 in) to be detectable to users of long canes.

Guidance:

Channelizing devices should be constructed and ballasted to perform in a predictable manner when inadvertently struck by a vehicle. Channelizing devices should be crashworthy. Fragments or other debris from the device or the ballast should not pose a significant hazard to road users or workers.

The spacing of channelizing devices should not exceed a distance in meters (feet) equal to 0.2 times the speed limit in km/h (1.0 times the speed limit in mph) when used for taper channelization, and a distance in meters (feet) equal to 0.4 times the speed limit in km/h (2.0 times the speed limit in mph) when used for tangent channelization.

When channelizing devices have the potential of leading vehicular traffic out of the intended vehicular traffic space as shown in Figure 6H-39, the channelizing devices should be extended a distance in meters (feet) of 0.4 times the speed limit in km/h (2.0 times the speed limit in mph) beyond the end of the transition area.

The spacing of channelizing devices should not exceed the maximum distances shown in Table 6F-102(CA).

Option:

Warning lights may be added to channelizing devices in areas with frequent fog, snow, or severe roadway curvature, or where visual distractions are present.

Standard:

Warning lights shall flash when placed on channelizing devices used alone or in a cluster to warn of a condition. Warning lights placed on channelizing devices used in a series to channelize road users shall be steady-burn.

The retroreflective material used on channelizing devices shall have a smooth, sealed outer surface that will display a similar color day or night.

Option:

The name and telephone number of the highway agency, contractor, or supplier may be shown on the nonretroreflective surface of all types of channelizing devices.

Standard:

The letters and numbers of the name and telephone number shall be nonretroreflective and not over 50 mm (2 in) in height.

Guidance:

Particular attention should be given to maintaining the channelizing devices to keep them clean, visible, and properly positioned at all times.

Standard:

Devices that are damaged or have lost a significant amount of their retroreflectivity and effectiveness shall be replaced.

Section 6F.59 Cones

Standard:

Cones (see Figure 6F-7, Sheet 1 of 2) shall be predominantly orange and shall be made of a material that can be struck without causing damage to the impacting vehicle. For ~~daytime and low speed~~ roadways, with speeds of 50 mph or less, cones shall be not less than ~~450 mm (18 in)~~ 28 in in height. When cones are used on ~~freeways and other high-speed highways or at night on all highways~~, roadways with speeds greater than 50 mph or when more conspicuous guidance is needed, cones shall be a minimum of ~~700 mm (28 in)~~ in height 36 in high.

For nighttime use, cones shall be retroreflectorized or equipped with lighting devices for maximum visibility. Retroreflectorization of cones that are 700 to 900 mm (28 to 36 in) in height shall be provided by a 150 mm (6 in) wide white band located 75 to 100 mm (3 to 4 in) from the top of the cone and an additional 100 mm (4 in) wide white band located approximately 50 mm (2 in) below the 150 mm (6 in) band.

Retroreflectorization of cones that are more than 900 mm (36 in) in height shall be provided by horizontal, circumferential, alternating orange and white retroreflective stripes that are 100 to 150 mm (4 to 6 in) wide. Each cone shall have a minimum of two orange and two white stripes with the top stripe being orange. Any nonretroreflective spaces between the orange and white stripes shall not exceed 75 mm (3 in) in width.

Support:

The 900 mm (36 in) and 1050 mm (42 in) high cones provide additional conspicuity in visually complex environments and for older road users.

Option:

Traffic cones may be used to channelize road users, divide opposing vehicular traffic lanes, divide lanes when two or more lanes are kept open in the same direction, and delineate short duration maintenance and utility work.

Guidance:

Steps should be taken to minimize the possibility of cones being blown over or displaced by wind or moving vehicular traffic.

Cones should not be used for pedestrian channelization or as pedestrian barriers in TTC zones on or along sidewalks unless they are continuous between individual devices and detectable to users of long canes.

Option:

Cones may be doubled up to increase their weight.

Support:

Some cones are constructed with bases that can be filled with ballast. Others have specially weighted bases, or weight such as sandbag rings that can be dropped over the cones and onto the base to provide added stability.

Guidance:

Ballast should be kept to the minimum amount needed.

Option:

Retroreflectorization of 700 mm (28 in) or larger cones may be provided by a 325 mm (13 in) band (sleeve).

Standard:

On State highways, the retroreflectorized bands shall be visible at 300 m (1000 ft) at night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.

Guidance:

On local roads, the retroreflectorized bands should be visible at 300 m (1000 ft) at night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.

Support:

Refer to Department of Transportation's Standard Specifications Section 12-3.10 for visibility criteria cited. See

Section 1A.11 for information regarding this publication.

Section 6F.60 Tubular Markers**Standard:**

Tubular markers (see Figure 6F-7, Sheet 1 of 2) shall be predominantly orange and shall be not less than ~~450 mm (18 in) high and~~ 50 mm (2 in) wide facing road users. They shall be made of a material that can be struck without causing damage to the impacting vehicle.

Tubular markers shall be ~~a minimum not less than 42 in high. of 700 mm (28 in) in height when they are used on freeways and other high-speed highways, on all highways during nighttime, or whenever more conspicuous guidance is needed.~~

For nighttime use, tubular markers shall be retroreflectorized. Retroreflectorization of ~~700 mm (28 in) or larger~~ tubular markers shall be provided by two 75 mm (3 in) wide white bands placed a maximum of 50 mm (2 in) from the top with a maximum of 150 mm (6 in) between the bands.

Support:

The 1050 mm (42 in) high tubular markers provide additional conspicuity in visually complex environments and for older road users.

Guidance:

Tubular markers should not be used for pedestrian channelization or as pedestrian barriers in TTC zones on or along sidewalks unless they are continuous between individual devices and detectable to users of long canes.

Tubular markers have less visible area than other devices and should be used only where space restrictions do not allow for the use of other more visible devices.

Tubular markers should be stabilized by affixing them to the pavement, by using weighted bases, or weights such as sandbag rings that can be dropped over the tubular markers and onto the base to provide added stability. Ballast should be kept to the minimum amount needed.

Option:

Tubular markers may be used effectively to divide opposing lanes of road users, divide vehicular traffic lanes when two or more lanes of moving motor vehicle traffic are kept open in the same direction, and to delineate the edge of a pavement drop off where space limitations do not allow the use of larger devices.

Section 6F.101(CA) Channelizers (Permanent type, flexible post)**Support:**

Channelizers are implanted in the ground or affixed to the pavement, and are not susceptible to displacement, and are capable of normally withstanding numerous vehicular impacts.

Channelizers are generally used in series to create a visual fence/barrier, to provide additional guidance and/or restriction to traffic.

Option:

They also may be used in lieu of cones, portable delineators, or drums, to channelize traffic, divide opposing lanes of traffic, etc.

Standard:

The design of a channelizer shall be as shown in Figure 6F-102(CA).

The height shall be 900 mm (36 in) minimum (700 mm (28 in) where speeds are 65 km/h (40 mph) or less), the width of the post shall be 56 mm (2 ¼ in) minimum and the color predominantly orange. The 75 x 300 mm (3 x 12 in) minimum retroreflective unit shall be visible at 300 m (1000 ft) at night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.

The color of the channelizer retroreflective unit shall be white and posts shall be orange.

The spacing of channelizers shall not exceed the maximum distances shown in Table 6F-102 (CA).

Support:

Refer to Department of Transportation's Standard Specifications Section 12-3.07 for visibility criteria cited. See Section 1A.11 for information regarding this publication.

Refer Chapter 3F for other details and requirements of channelizers.

California MUTCD
(FHWA's MUTCD 2003 including Revisions 1 and 2, as amended for use in California)

Page 6C-13

Table 6C-1 ~~Suggested Advance Warning Sign Spacing~~
Suggested Minimum Advance Warning Sign Spacing

Road Type	Distance Between Signs**		
	A	B	C
Urban (low speed)* (25 mph or less)	30 (100)	30 (100)	30 (100)
Urban (high speed)* (30 and 35 mph) or more	100 (350)	100 (350)	100 (350)
Rural or Urban (40 to 50 mph)*	150 (500)	150 (500)	150 (500)
Expressway / Freeway Freeway / Expressway / Urban (55 mph and above)*	300 (1,000)	450 (1,500)	800 (2,640)

* Speed category to be determined by highway agency

** Distances are shown in meters (feet). The column headings A, B, and C are the dimensions shown in Figures 6H-1 through 6H-46. The A dimension is the distance from the transition or point of restriction to the first sign. The B dimension is the distance between the first and second signs. The C dimension is the distance between the second and third signs. (The third sign is the first one in a three-sign series encountered by a driver approaching a TTC zone.)

Table 6C-2. Stopping Sight Distance as a Function of Speed







Speed* (km/h)	Distance (m)	Speed* (mph)	Distance (ft)
30	35	20	115
40	50	25	155
50	65	30	200
60	85	35	250
70	105	40	305
80	130	45	360
90	160	50	425
100	185	55	495
110	220	60	570
120	250	65	645
		70	730
		75	820

* Posted speed, off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed

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Figure 6F-6. Advance Warning Arrow Display Specifications

Operating Mode		Panel Display (Type C panel illustrated)		
I. At least one of the three following modes shall be provided:		(Right arrow shown; left is similar)		
Flashing Arrow		 Move/Merge Right		
Sequential Arrow		 Move/Merge Right		
Sequential Chevron		 Move/Merge Right		
II. The following mode shall be provided:		 Move/Merge Right or Left		
III. The following mode shall be provided:		 or  Caution Caution		
Panel Type	Minimum Size	Minimum Legibility Distance	Minimum Number of Elements	Appropriate Use
A	1200 x 600 mm (48 x 24 in)	0.8 km (1/2 mi)	12	Low-speed urban streets
B or I**	1500 x 750 mm (60 x 30 in) 1800 x 900 mm (72 x 36 in)*	1.2 km (3/4 mi)	13	Intermediate-speed facilities and maintenance or mobile operations on high-speed roadways
C or I**	2400 x 1200 mm (96 x 48 in)	1.6 km (1 mi)	15	High-speed, high volume roadways
D	None*	0.8 km (1/2 mi)	12	On authorized vehicles

*Length of arrow equals 1200 mm (48 in), width of arrowhead equals 600 mm (24 in)

Standard:

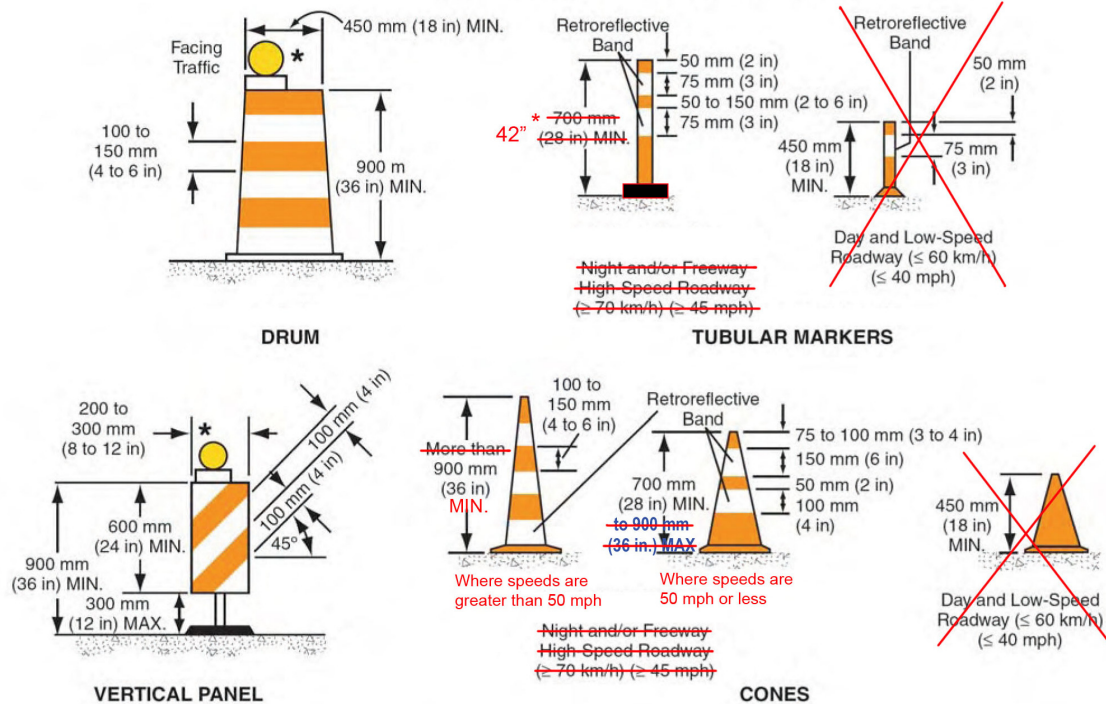
* - For State highways, the panel type B (or type II) shall have a minimum size of 1800 x 900 mm (72 x 36 in).

** - For State highways, the panel type B shall mean type II and the panel type C shall mean type I.

California MUTCD
(FHWA's MUTCD 2003 including Revisions 1 and 2, as amended for use in California)

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Figure 6F-7. Channelizing Devices (Sheet 1 of 2)



* Warning lights (optional)

Note: If drums, cones, or tubular markers are used to channelize pedestrians, they shall be located such that there are no gaps between the bases of the devices, in order to create a continuous bottom, and the height of each individual drum, cone, or tubular marker shall be no less than 900 mm (36 in) to be detectable to users of long canes.

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California MUTCD
(FHWA's MUTCD 2003 including Revisions 1 and 2, as amended for use in California)

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**Figure 6F-101 (CA). California Temporary Traffic Control Signs
(Sheet 1 of 2)**



California MUTCD
(FHWA's MUTCD 2003 including Revisions 1 and 2, as amended for use in California)

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**Figure 6F-101 (CA). California Temporary Traffic Control Signs
(Sheet 2 of 2)**

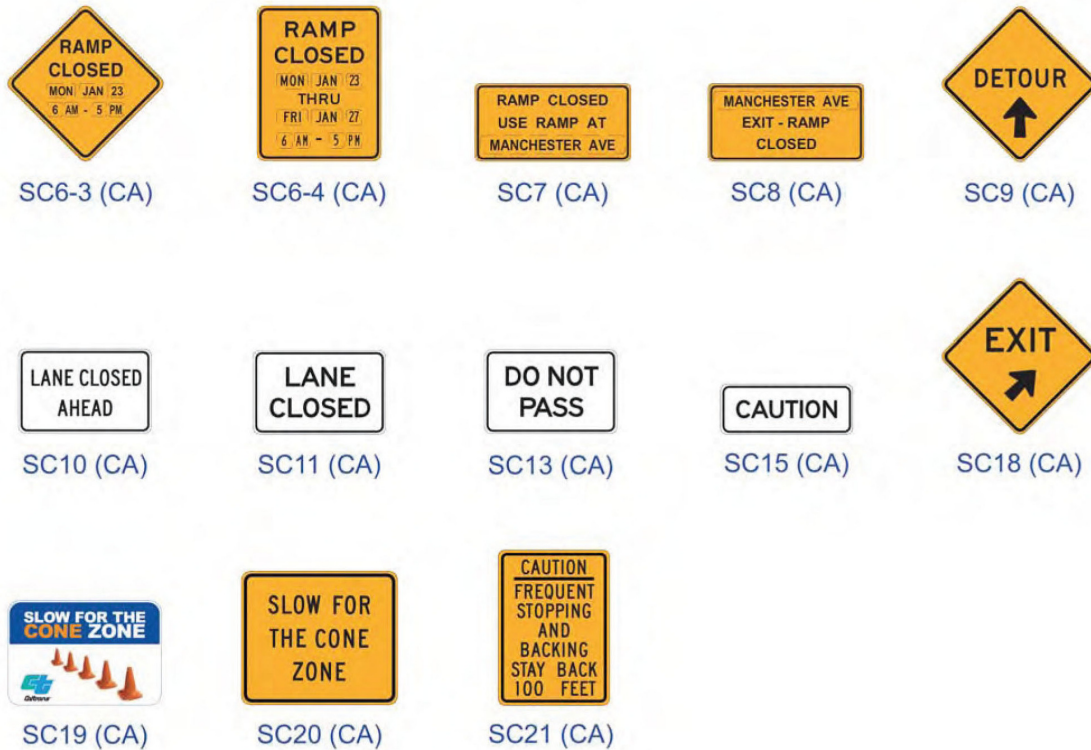
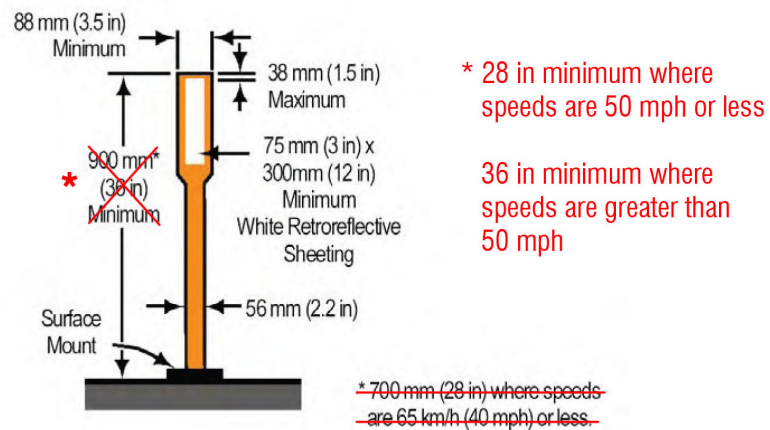


Figure 6F-102 (CA). Channelizer



California MUTCD
(FHWA's MUTCD 2003 including Revisions 1 and 2, as amended for use in California)

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Figure 6H-18. Lane Closure on Minor Street (TA-18)

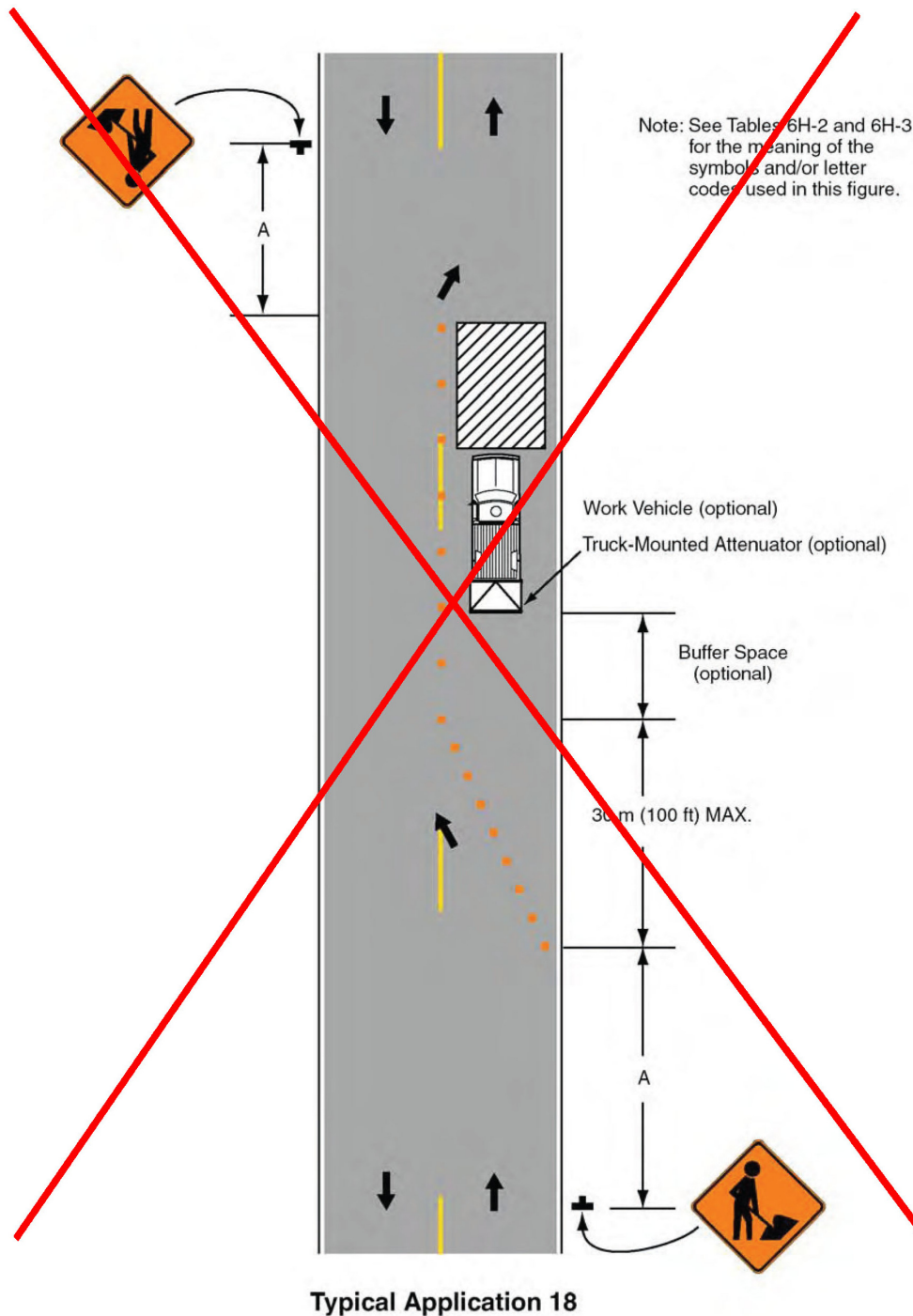


Figure 6H-18A(CA). Lane Closure on Minor Street (TA-18)

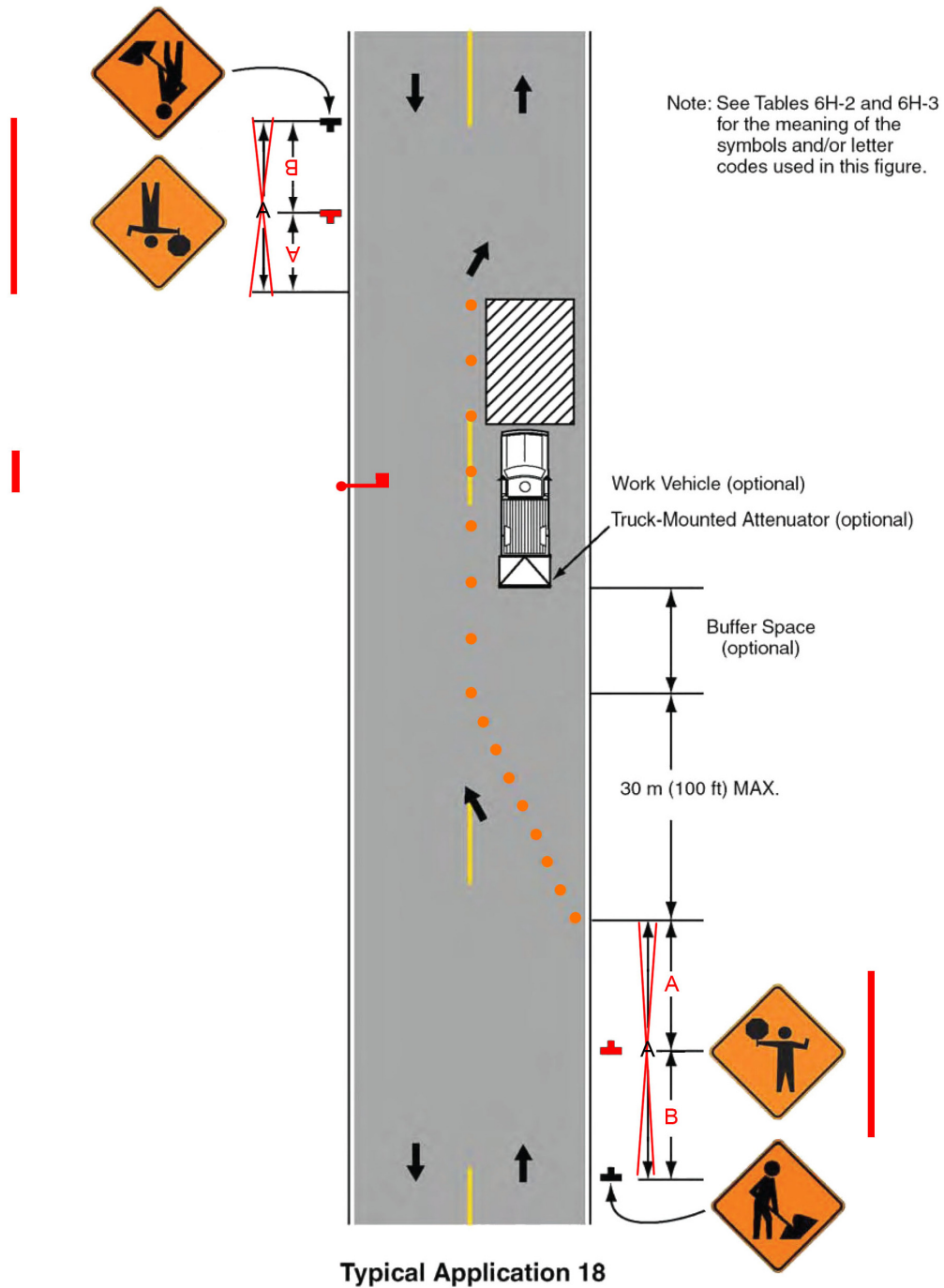


Figure 6H-18B(CA) Work on Minor Street

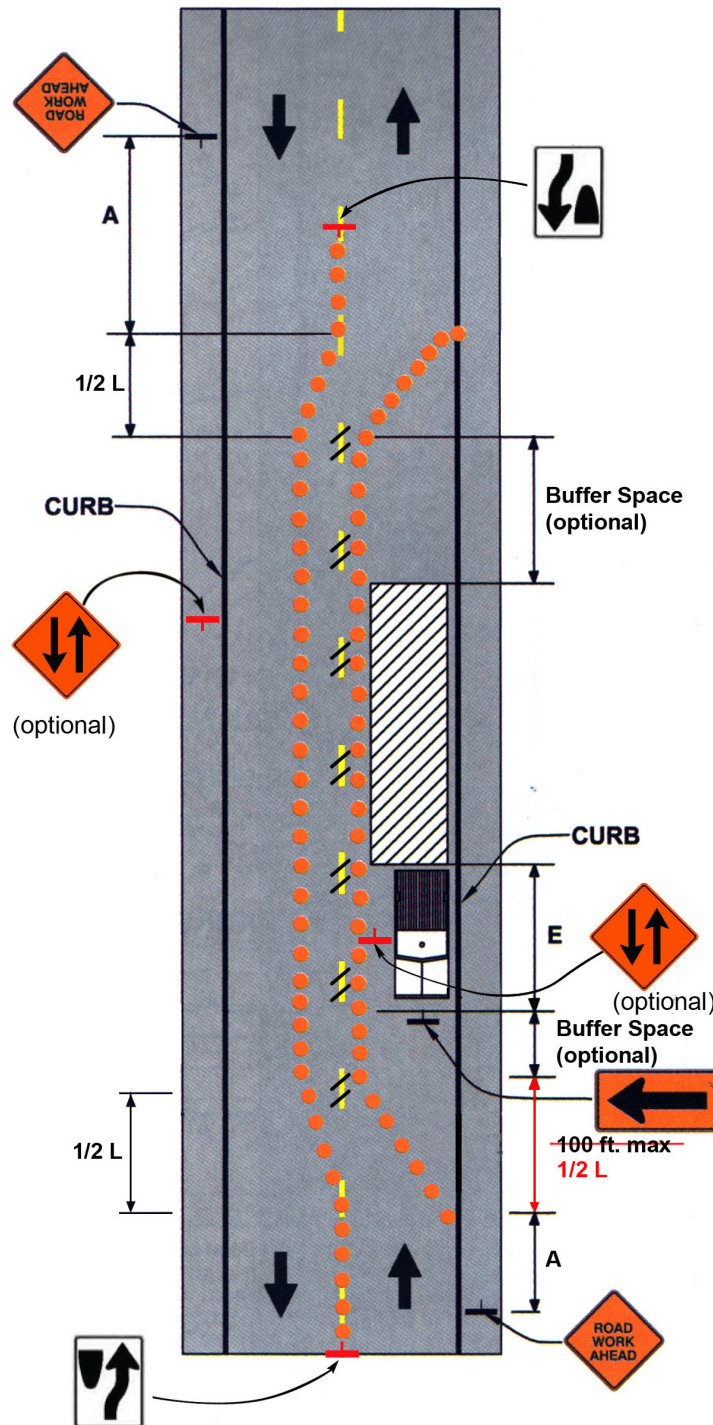


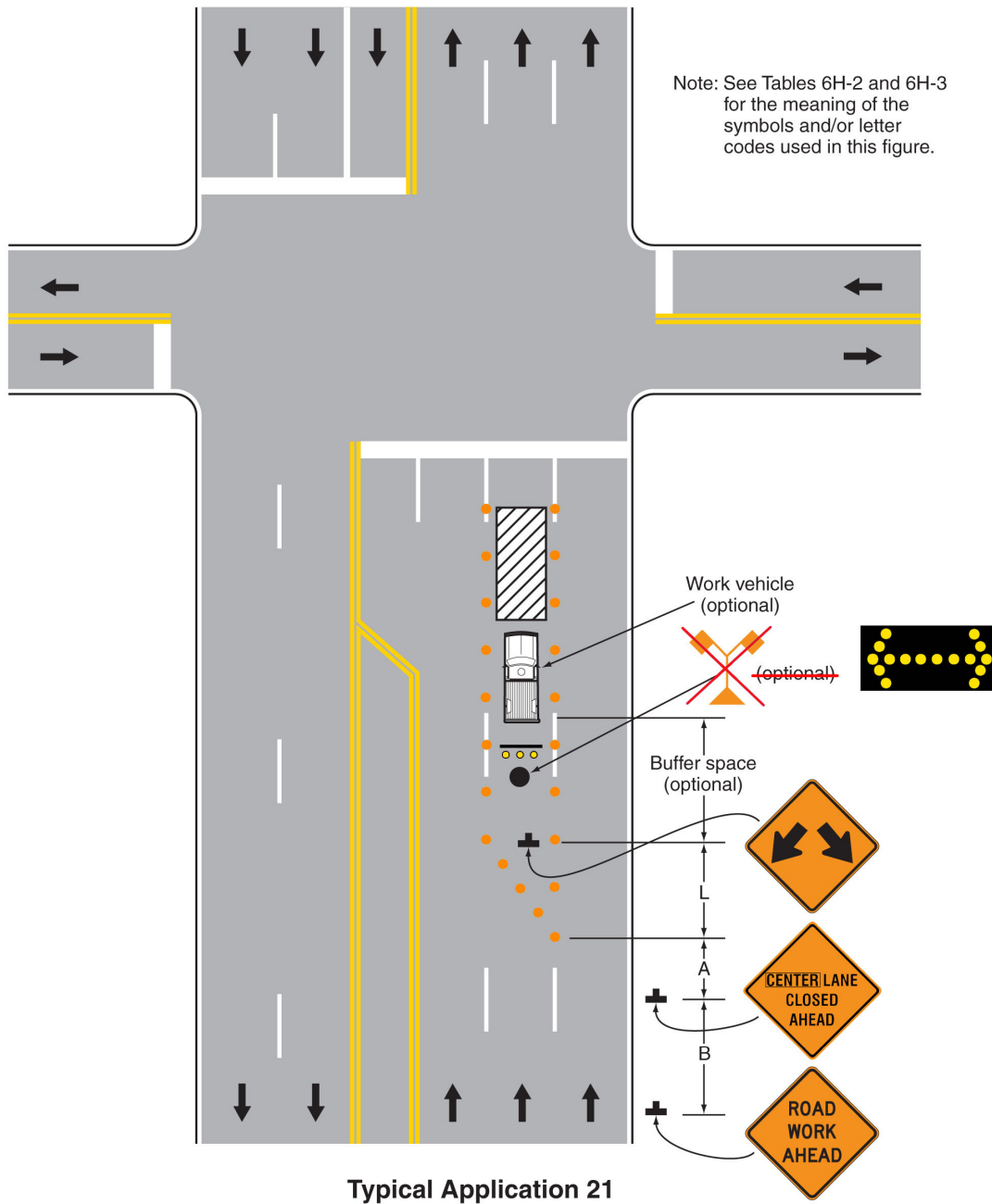
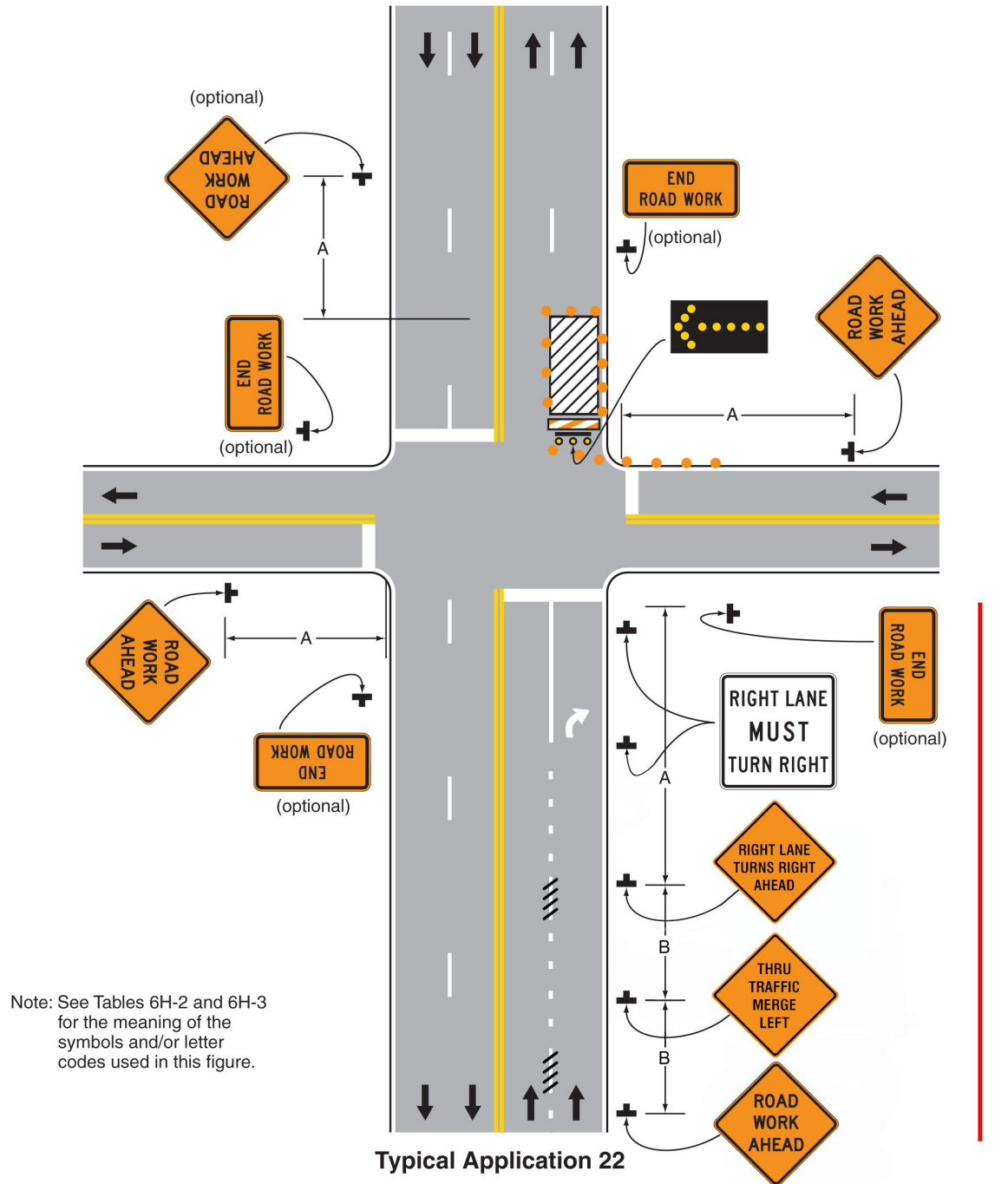
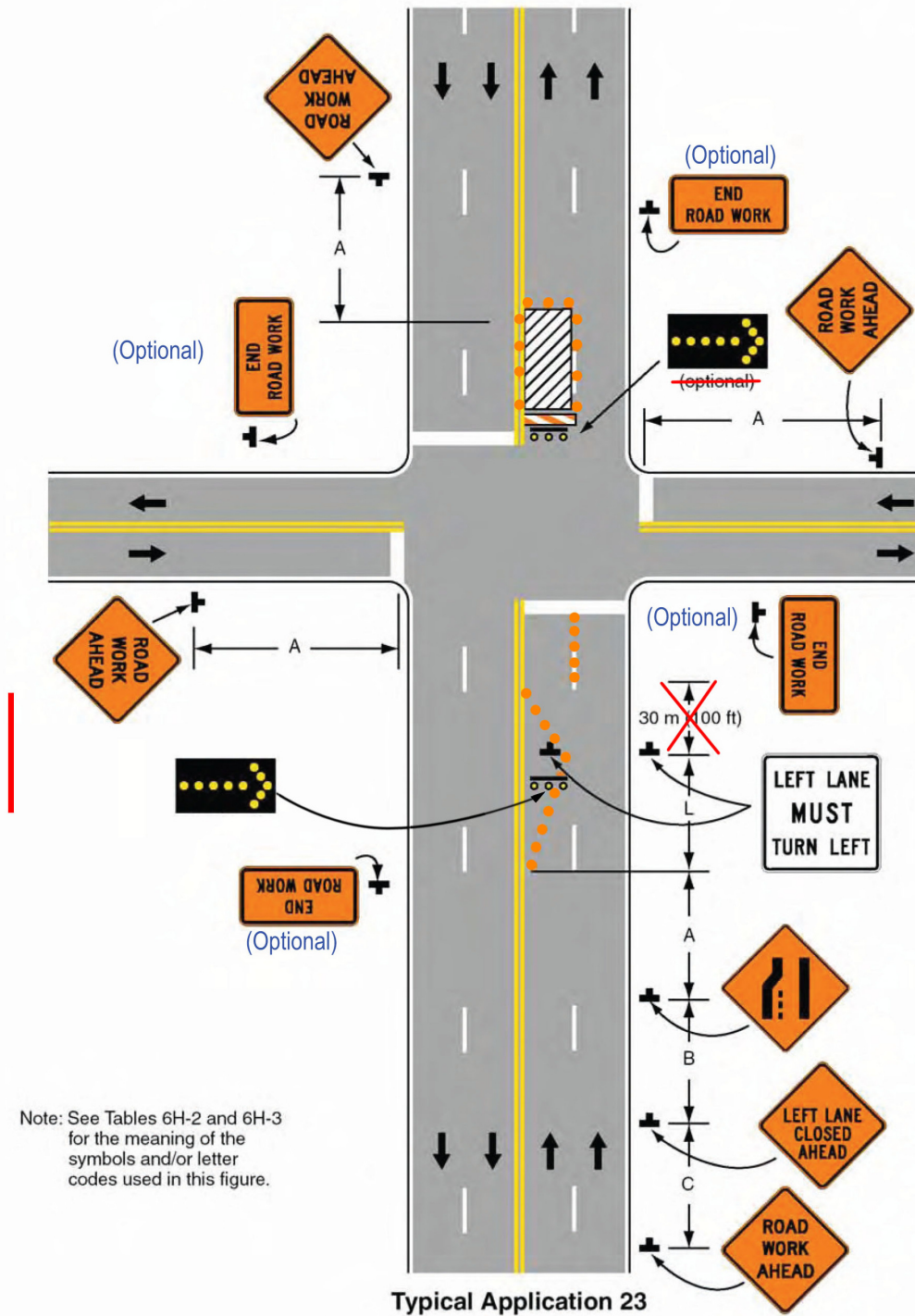
Figure 6H-21. Lane Closure on the Near Side of an Intersection (TA-21)

Figure 6H-22A(CA). Right-Hand Lane Closure on the Far Side of an Intersection (TA-22)

California MUTCD
(FHWA's MUTCD 2003 including Revisions 1 and 2, as amended for use in California)

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Figure 6H-23. Left Lane Closure on Far Side of Intersection (TA-23)



California MUTCD
(FHWA's MUTCD 2003 including Revisions 1 and 2, as amended for use in California)

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Figure 6H-24 · Half Road Closure on Far Side of Intersection (TA-24)

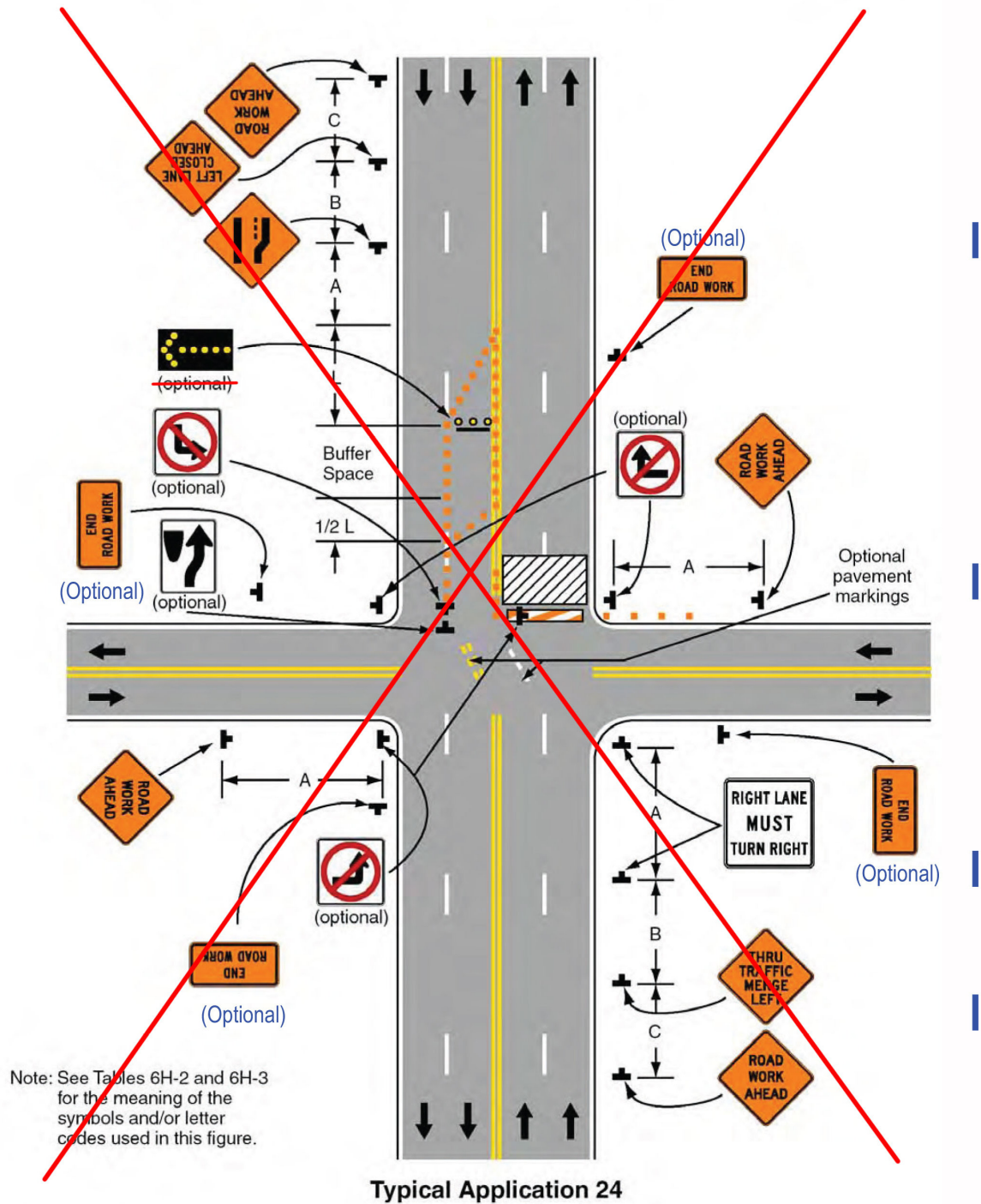


Fig 6H-24(CA)

California MUTCD

(FHWA's MUTCD 2003 including Revisions 1 and 2, as amended for use in California)

Page 6H-61

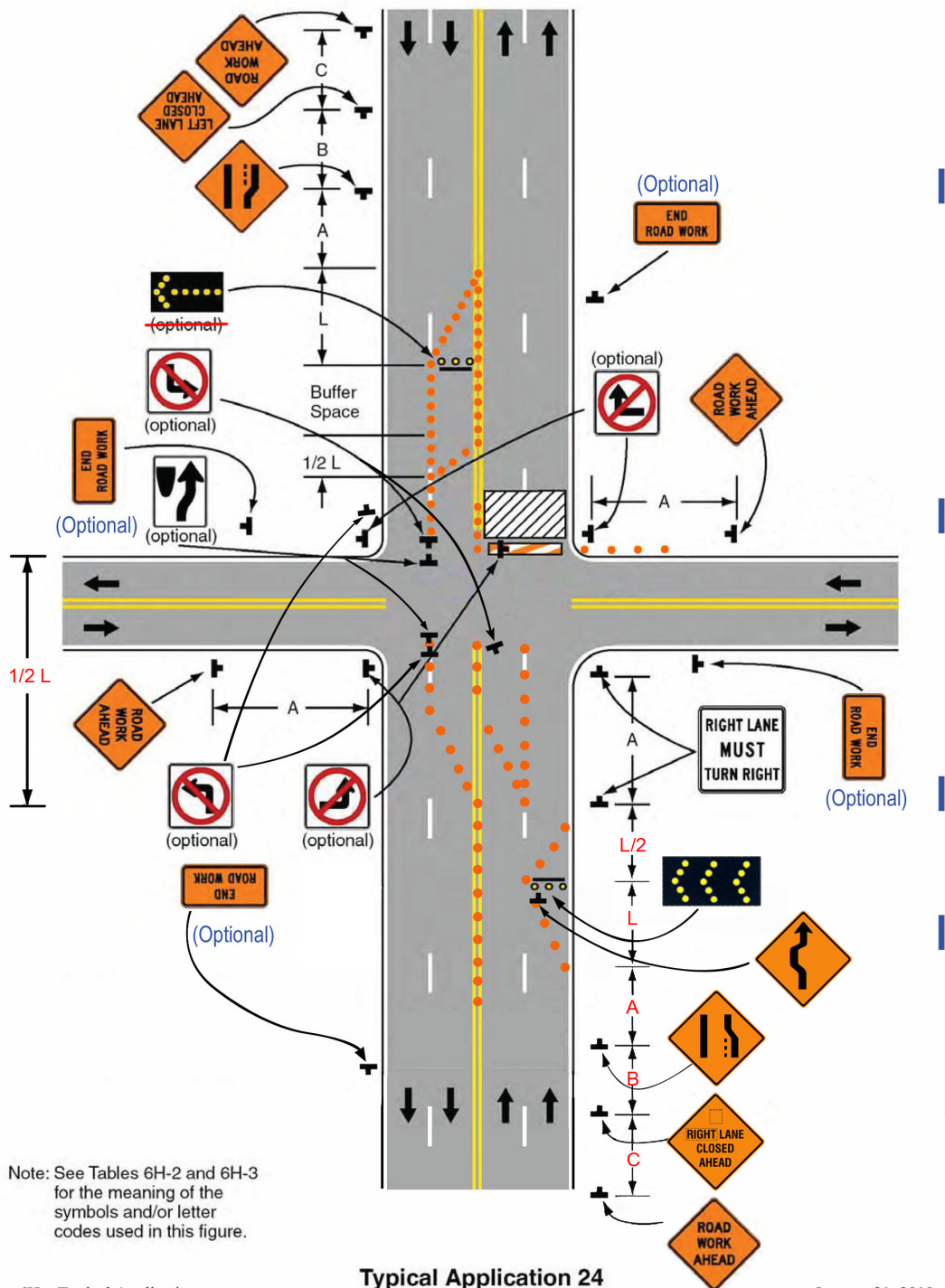
Figure 6H-24. Half Road Closure on Far Side of Intersection (TA-24)

Figure 6H-25. Multiple Lane Closures at an Intersection (TA-25)

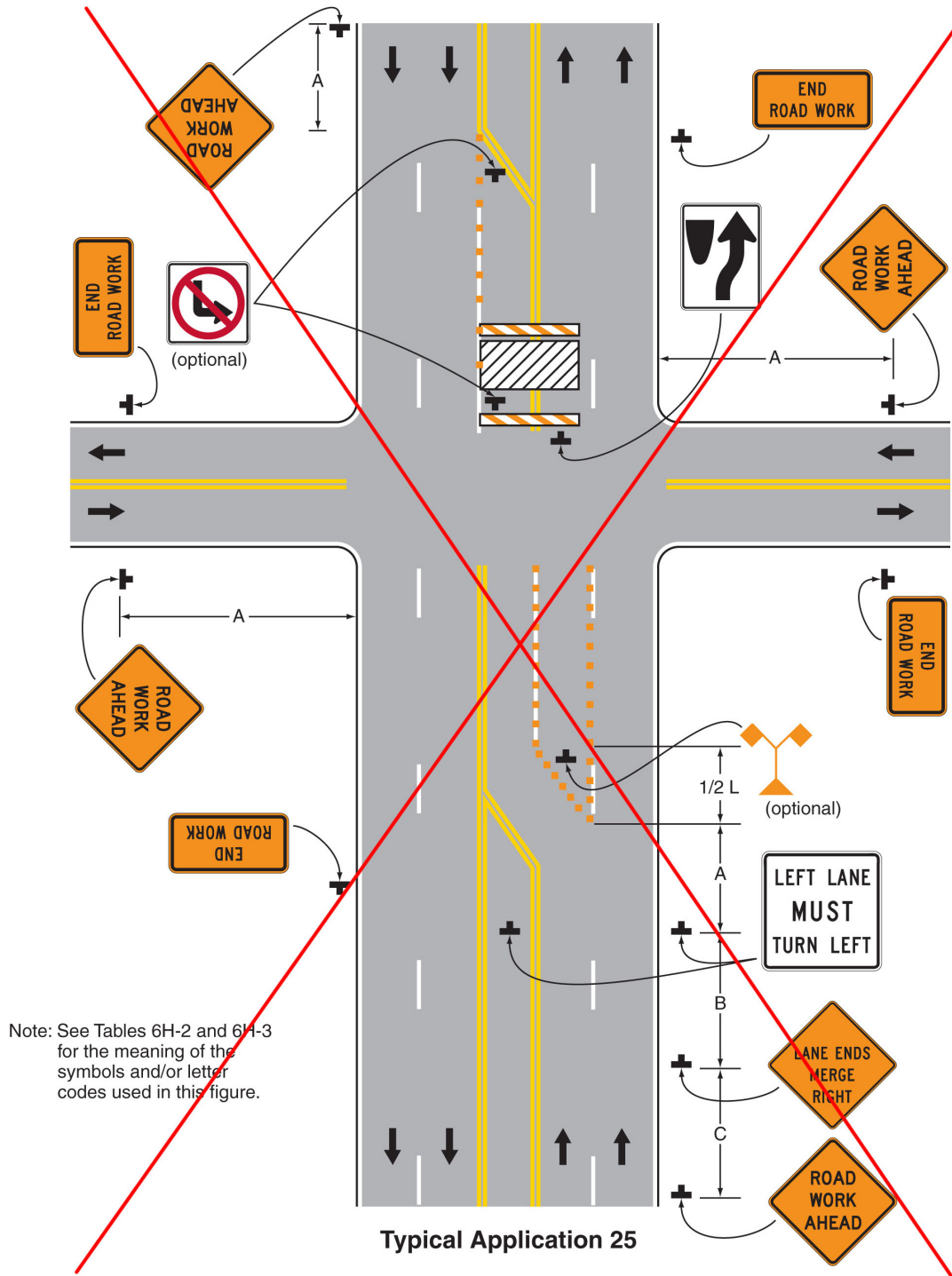
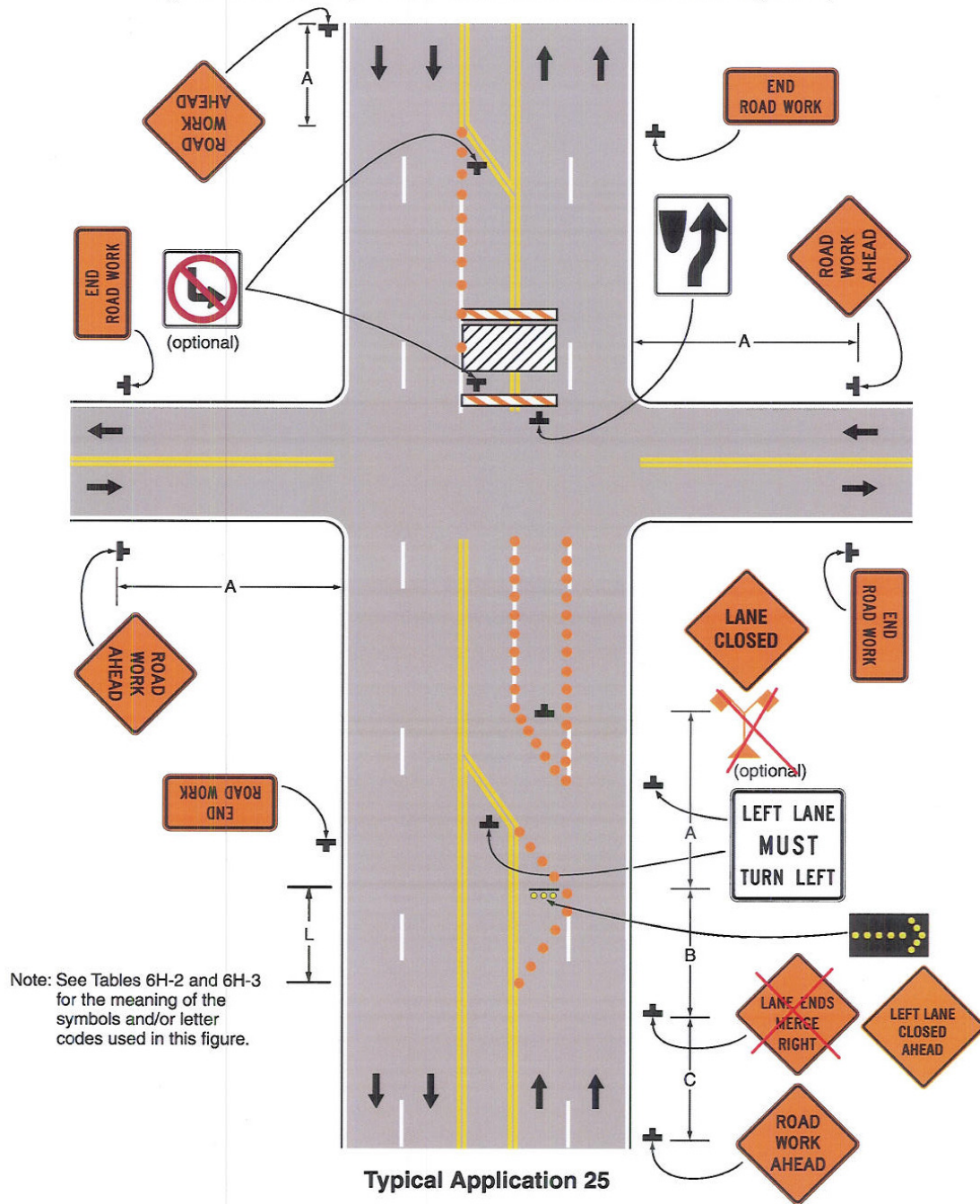


Fig 6H-25(CA)

2009 Edition

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Figure 6H-25. Multiple Lane Closures at an Intersection (TA-25)

California MUTCD
(FHWA's MUTCD 2003 including Revisions 1 and 2, as amended for use in California)

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Figure 6H-30. Interior Lane Closure on Multi-lane Street (TA-30)

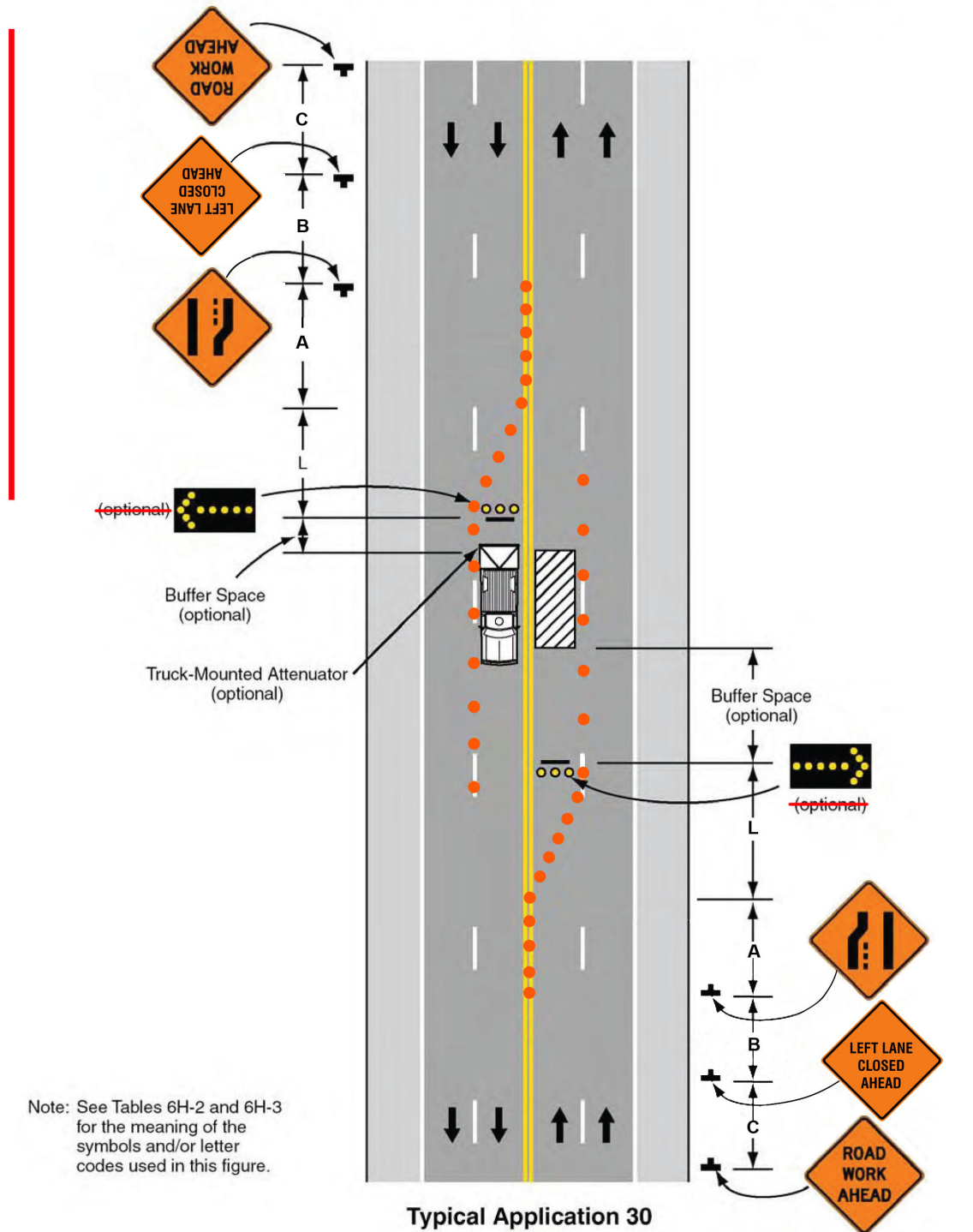
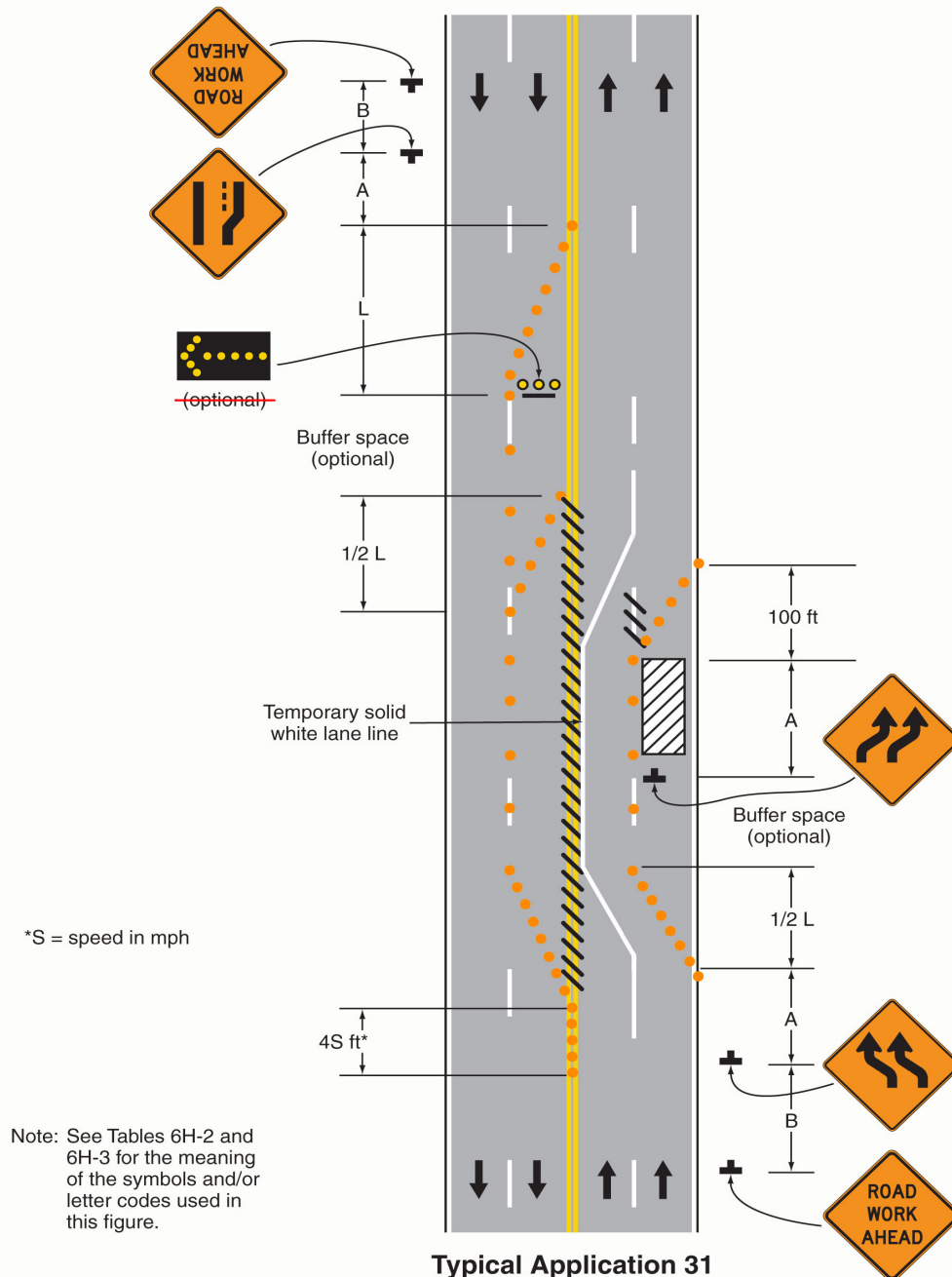


Figure 6H-31 (CA). Lane Closures on Street with Uneven Directional Volumes (TA-31)

California MUTCD
(FHWA's MUTCD 2003 including Revisions 1 and 2, as amended for use in California)

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Figure 6H-32 (CA). Half Road Closure on Multilane, High-Speed Highway (TA-32)

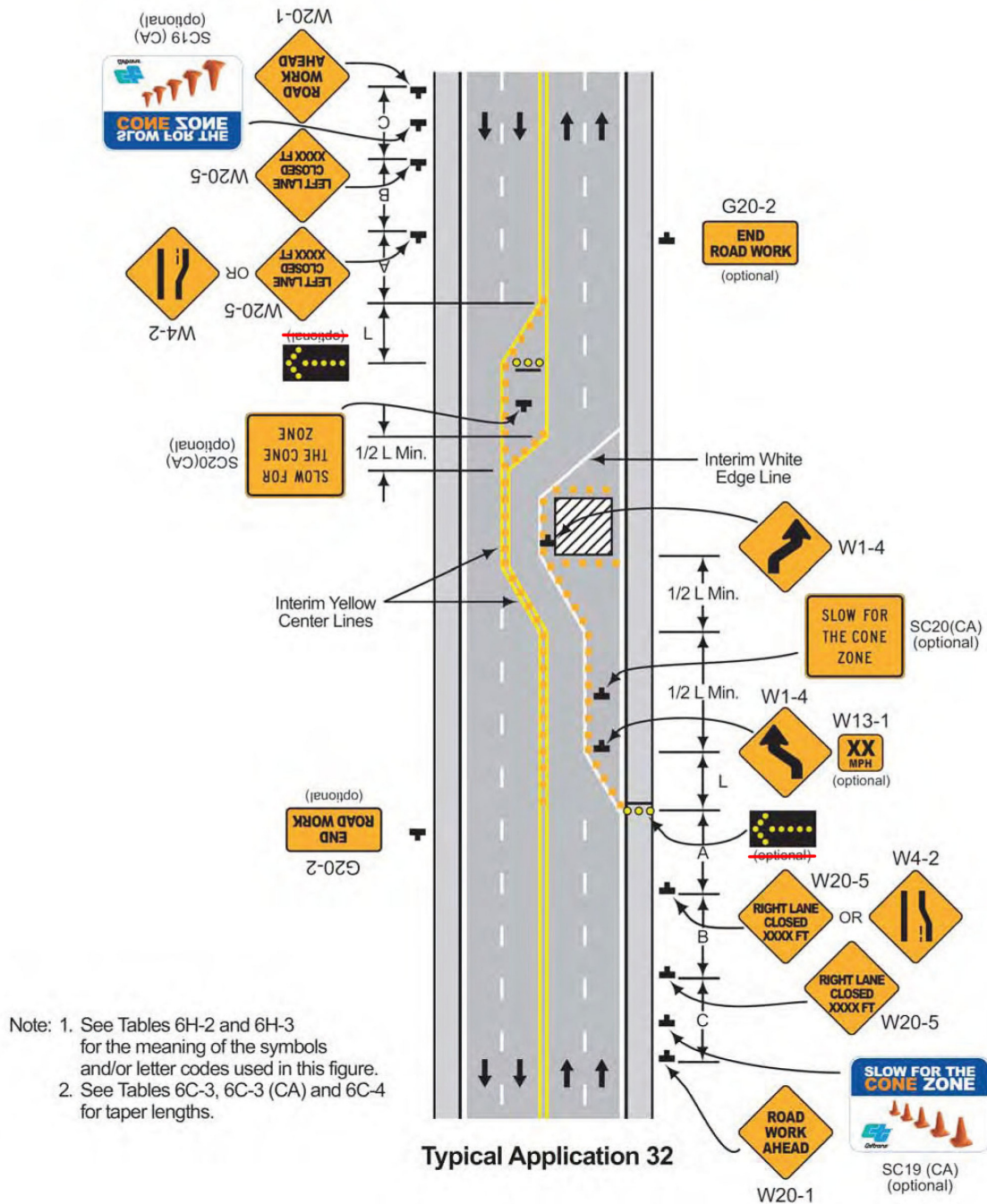


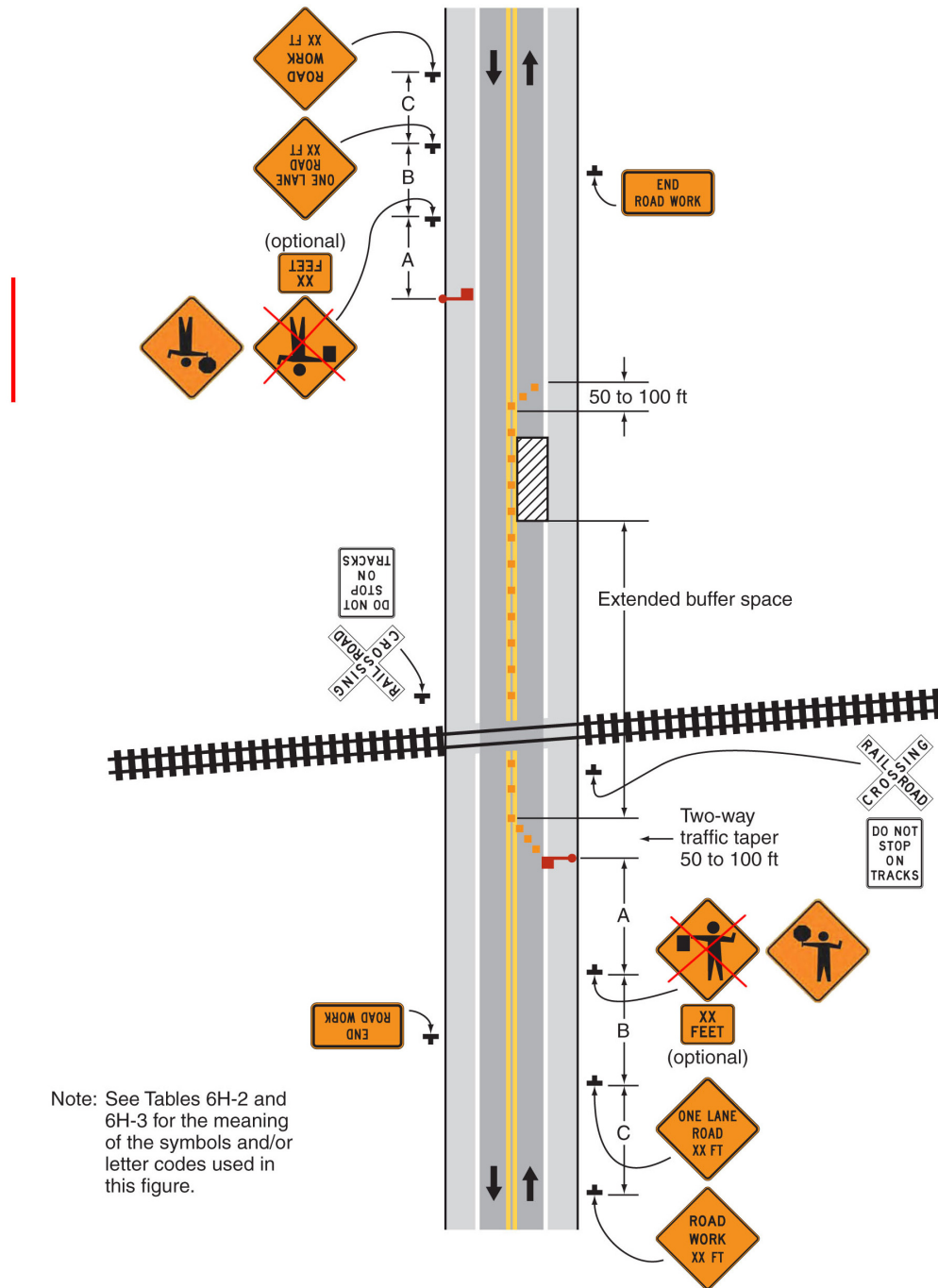
Figure 6H-46A(CA). Work in the Vicinity of a Grade Crossing (TA-46)**Typical Application 46**

Figure 6H-46B(CA). Work in Vicinity of a Grade Crossing

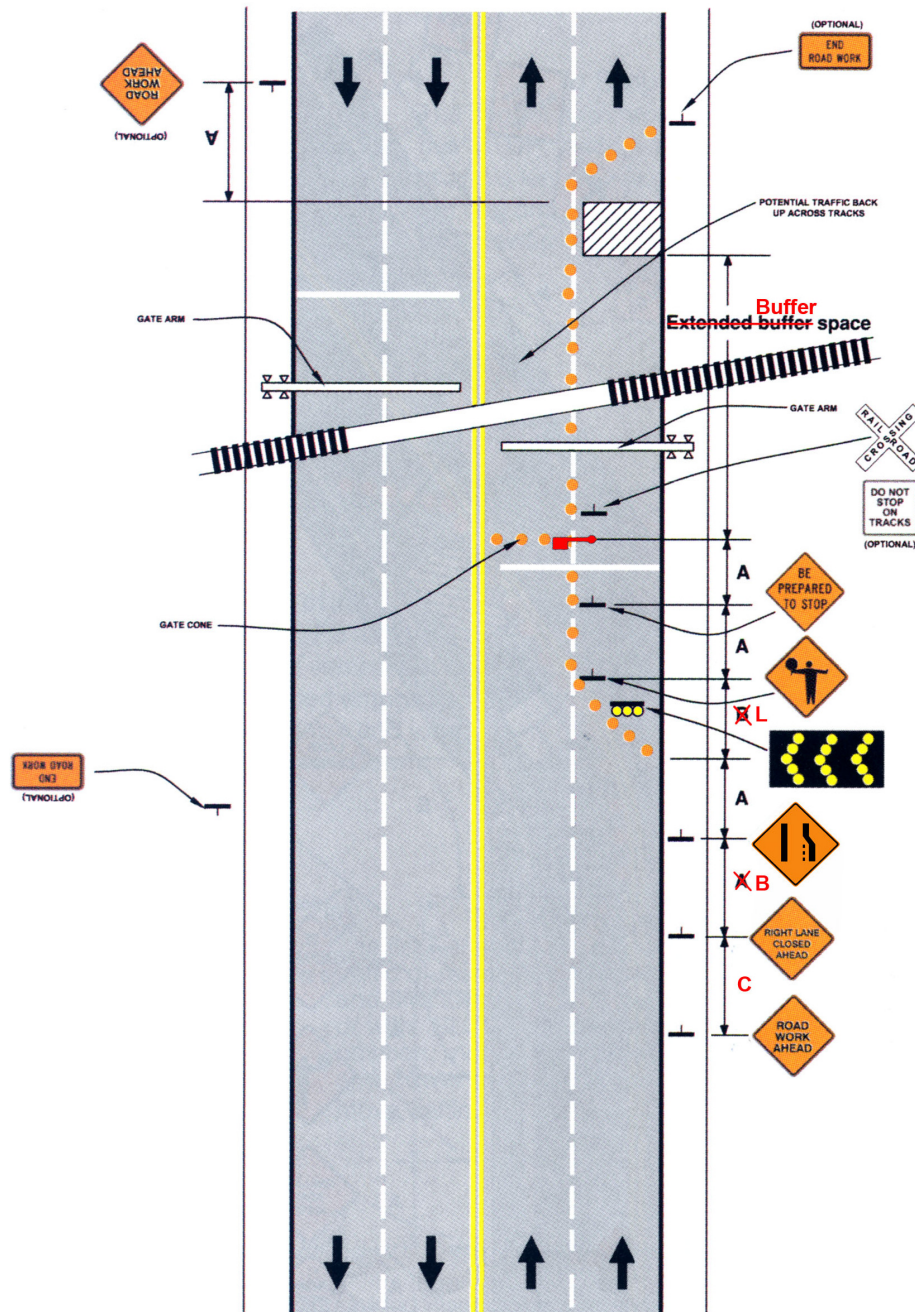
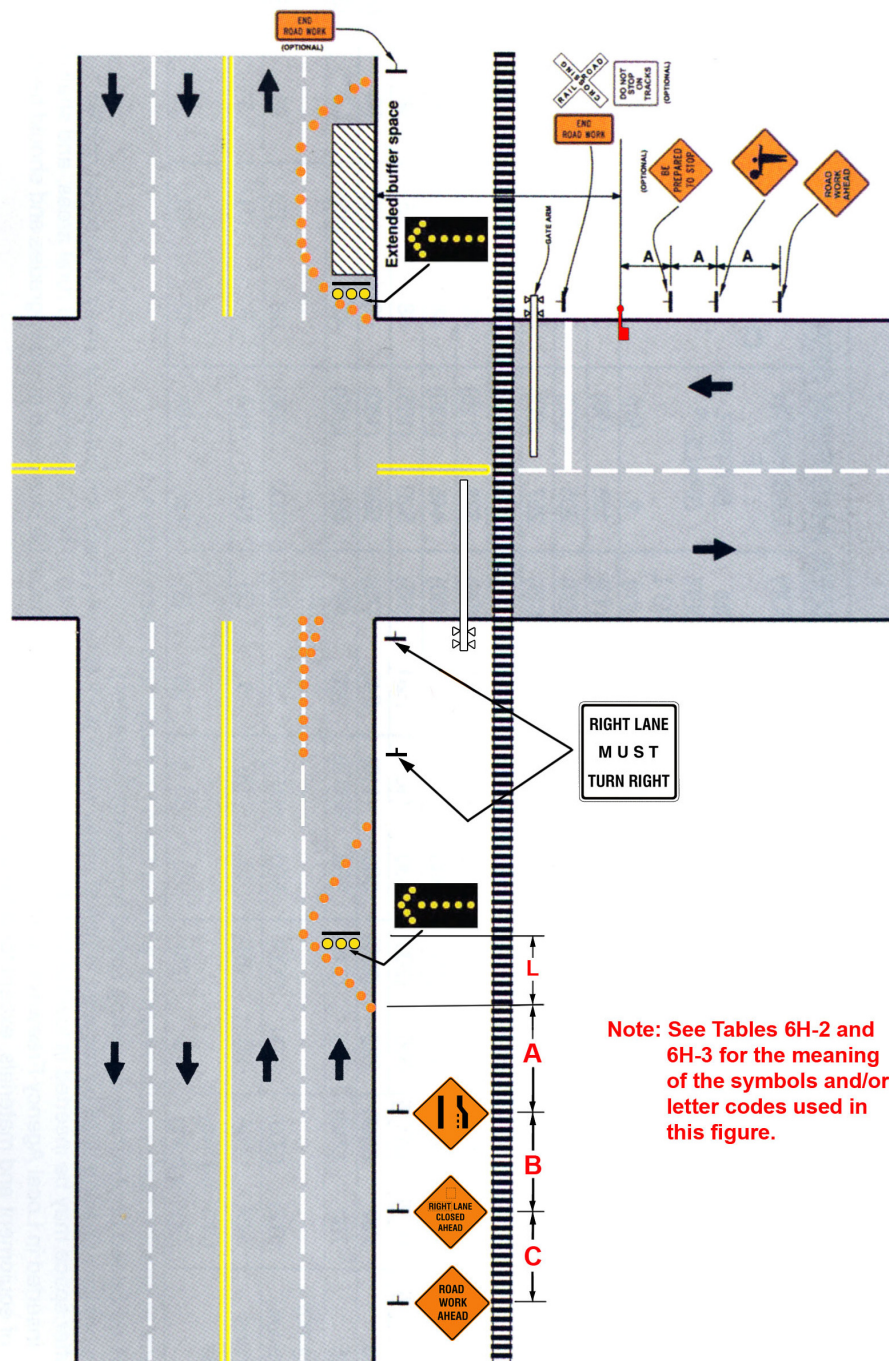


Figure 6H-46C(CA). Work in Vicinity of a Grade Crossing



5. Request for Experimentation:**10-10 Request for Permission to Experiment with modified SPEED HUMP (W17-1) Signs**

Proposal: City of Stockton request authorization to conduct an experiment with amended SPEED HUMPS sign.

Agency Making Request: City of Stockton

Sponsor: Jeff Knowles, CTCDC member representing Northern CA Cities

April 1, 2010

Secretary
California Traffic Control Devices Committee – MS36
P. O. Box 942874
Sacramento, CA 94274-0001

SUBJECT: REQUEST FOR PERMISSION TO EXPERIMENT

The City of Stockton California is requesting permission to experiment with signs used for the Neighborhood Traffic Management Program.

A. PROBLEM

The City of Stockton has installed approximately 270 speed humps/cushions on local streets since 2006. The W17-1 (Speed Hump) sign and more often the W17-1 in combination with the W13-1 (Advisory Speed) sign are placed on the approach of every hump/cushion location. In some neighborhoods this has led to sign pollution. Many residents have complained about the excessive number of signs in their neighborhoods, whereas drivers complain about not noticing signs or seeing chevrons (installed on humps/cushions) with sufficient reaction time.

The City of Stockton would like to experiment with two signs “Speed Humps Ahead” and “Speed Hump Area” to help curb the number of signs on city streets and at the same time advise drivers to the possibility of multiple humps/cushions in an area. Each sign would be used under specific circumstances as defined under the Work Plan section of this request. “BUMP” pavement markings will be included in the experiment to help address the visibility of individual humps and cushions.

We note that similar warning signs have been used in other communities although we could not confirm that this was through an experiment or approved by the California Traffic Control Devices Committee or FHWA.

B. PROPOSED CHANGES

The first proposed change to the 24” x 24” Speed Hump sign (W17-1) is to pluralize **Speed Hump** and add **“Ahead”**. Speed Humps Ahead with the Advisory Speed sign (W13-1) would be placed in advance of the first hump/cushion in a series of humps on a residential street segment or between traffic controlled intersections.

The second proposed change is to add “**Area**” to the 24” x 24” Speed Hump (W17-1) sign. This sign, Speed Hump Area will be used with the Advisory Speed sign at each entrance to a neighborhood with limited entrances.

C. ILLUSTRATION



D. SUPPORTING DATA

These signs and/or very similar signs have been used in other communities. The City of Sacramento lists the “Speed Humps Ahead” sign in their Speed Hump Program Guidelines although their sign also includes a single hump symbol. City of Belmont California and City of Hayward California have included “Bumps Ahead” signs in their Guidelines for Installation of Speed Humps.

Since the W17-1 has been used consistently throughout Stockton and is easily recognized, the proposed signs do not substantially deviate from the MUTCD approved sign.

MUTCD Section 2C.24 SPEED HUMP sign (W17-1) Option: *“If a series of speed humps exists in close proximity, an Advisory Speed plaque may be eliminated on all but the first SPEED HUMP sign in the series.”*

MUTCD Section 3B.27 Advance Speed Hump Markings Option: *“...Advance pavement wording such as BUMP or HUMP (see Section 3B.19) may be used on the approach to a speed hump either alone or in conjunction with advance speed hump markings. Appropriate advance warning signs may be used in conformance with Section 2C.24.”*

ITE Guidelines for the Design and Application of Speed Humps 2007 4.3.1 Spacing Page 41: *“A two-hump configuration may be satisfactory on single-block segments of*

moderate length (500 to 1,000 ft. [152 to 305 m]) On very long blocks (1,000 to 1,500 ft [305 to 457 m]) three or more humps may be necessary.”

4.4 Traffic Control Devices Page 43: *“Many agencies have developed and implemented speed hump signs and markings that are not included in the current edition of MUTCD. Consistency of traffic control devices used at speed hump installations within a jurisdiction is recommended to increase road user comprehension.”*

www.ite.org/traffic/hump.asp **Traffic Calming Measures - Speed Hump, Design/Installation Issues:** *“often have signage (advance warning sign before first hump in series and warning sign or object marker at hump)”*

MUTCD Section 2A.04 Excessive Use of Signs Guidance: *Regulatory and warning signs should be used conservatively because these signs, if used to excess, tend to lose their effectiveness. ...Support: Sign information overload occurs when the frequency of signing, complexity of messages or diversity of messages is so great that they cannot be readily assimilated...”*

E. LEGAL STATEMENT

A basic search of the on-line U. S. Patent and Trademark Office database did not reveal any signs similar to those proposed in this request. To the best of our knowledge, the City of Stockton certifies that the concept of the proposed traffic signs is not protected by a patent or copyright.

F. TIME PERIOD AND LOCATIONS

Currently the City of Stockton Neighborhood Traffic Management Program has waiting lists of seven to twelve years. A time period for experimentation of two years is requested. If experimentation is approved to begin in the City's Fiscal Year 2011/12 (July 2010) and continue through FY 2012/13 (June 2012), the City of Stockton will implement the experimental signage in the 16 neighborhoods beginning the Traffic Calming process where the specific conditions exist as stated in the Work Plan. Enclosed is a copy of the current neighborhood waiting lists for the Traffic Calming Program showing the 16 eligible neighborhoods.

G. WORK PLAN

Field reviews will be conducted in the 16 neighborhoods to be included in the study. Wherever the determining conditions are present, i.e., multiple humps or cushions on a street segment or limited access to a neighborhood, one of the following signs would be utilized. The neighborhood would then be subject to the testing criteria established in the Evaluation Plan Section.

Speed Humps Ahead

This sign will be used whenever two or more speed humps/cushions are to be placed on a street segment or between intersections. The approach to the first hump/cushion (each end) in the series shall be posted with the “Speed Humps Ahead” sign and the advisory speed sign. “BUMP” pavement markings will be placed 50’ (if possible) in advance of these humps/cushions in the opposite lane. All other speed humps/cushions in the series shall be marked on both sides with “BUMP” pavement markings 50’ (if possible) in advance of the humps. All speed humps/cushions shall continue to be marked with reflective thermoplastic chevrons.

Speed Hump Area:

When access to a neighborhood is limited, each entrance to the neighborhood shall be posted with the “Speed Hump Area” warning sign and the advisory speed sign. “BUMP” pavement markings will be

placed in each lane, 50' (if possible) in advance of each hump. All speed humps/cushions shall continue to be marked with reflective thermoplastic chevrons.

One variable which can be measured quantitatively and is a main objective of the study is the number of signs eliminated under this experiment as opposed to our current program. Accident statistics will be compared pre and post experiment as well as compared with neighborhoods traffic calmed using the previous warning signs.

Many of the variables to be considered through this experiment are subjective. Does one advance warning sign effectively replace repetitive signs? Do BUMP Pavement Markings give adequate notification of the speed hump's presence? Are speed humps more visible with the BUMP pavement marking than the warning signs and chevrons? Does the warning of multiple humps eliminate speeding between measures? Residents will need to be polled to determine whether the experimental procedures have improved their perceived traffic issues in the neighborhood.

H. DETAILED RESEARCH (EVALUATION PROCEDURES)

As each of the 16 neighborhoods begins the traffic calming process, residents actively participating will be asked to complete a survey to rate their perception of the City traffic calming program prior to traffic calming in their neighborhood, advantages, problems, signage, visibility, effectiveness, etc. After-implementation studies will request those same residents assess the warning notifications in their neighborhood, improvements, problems, etc. Evaluation reports will be based on this input, any input from other residents, and observations of Traffic Engineering staff members. Evaluations will also include any available police reports and accident statistics related to traffic calmed streets.

I. AGREEMENT

The City of Stockton agrees that a written status report will be forwarded to the California Traffic Control Devices Committee 45 days prior to each public meeting. A final report will be provided within 90 days of the terminal date of the experimentation. Within three months of the end of this experiment, if deemed appropriate by FHWA, the experimental signs will be removed and replaced with the original W17-1 Speed Hump sign. In addition, the City will terminate the experimentation at any time that it determines significant safety concerns are directly or indirectly attributable to the experimentation.

The City of Stockton agrees to provide a copy of the final results of the experimentation to the FHWA Office of Transportation Operations within three months following completion of the experimentation.

ROBERT MURDOCH, DIRECTOR
PUBLIC WORKS DEPARTMENT

Original signed by:

TODD GREENWOOD
ASSISTANT CITY TRAFFIC ENGINEER

RKM:TG:sa

emc: Federal Highway Administration (FHWA),
Office of Transportation Operations, MUTCD
MUTCDofficialrequest@dot.gov
::ODMA\GRPWISE\COS.PW.PW_Library:153090.1

Signage Guidelines for Speed Hump/Cushion Series**Speed Humps Ahead:**

When 2 or more speed humps/cushions are to be placed on a street segment or between intersections:

The approach to the first hump/cushion (each end) in the series shall be posted with the “Speed Humps Ahead” sign and the advisory speed sign. “BUMP” pavement markings will be placed 50’ in advance of these humps/cushions in the opposite lane.

All other speed humps in the series shall be marked on both sides with “BUMP” pavement legends 50’ in advance of the humps.

All speed humps/cushions shall be additionally marked with reflective thermoplastic chevrons.

Speed Hump Area:

When access to a neighborhood is limited:

Each entrance to the neighborhood shall be posted with the “Speed Hump Area” sign and the advisory speed sign.

“BUMP” pavement markings will be placed in each lane, 50’ in advance of each hump.

All speed humps/cushions shall be additionally marked with reflective thermoplastic chevrons.

CITY OF STOCKTON
NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM
WAITING LISTS BY CITY QUADRANT

	<u>NORTHWEST NEIGHBORHOODS</u>	<u>STATUS</u>		<u>SOUTHWEST NEIGHBORHOODS</u>	<u>STATUS</u>		<u>SOUTHEAST NEIGHBORHOODS</u>	<u>STATUS</u>		<u>NORTHEAST NEIGHBORHOODS</u>	<u>STATUS</u>
1	Iron Canyon Circle (2004/05+)	Completed	1	Golf Course Terrace (2004/05+)	Completed	1	Sharps Lane Villas (2004/05+)	Completed	1	Normandy Village (2004/05+)	Completed
2	Colonial Estates N. (2005/06+)	Completed	2	West of Center (2004/05+)	Completed	2	Highland Park (2005/06+)	Completed	2	Pacific Oaks (2005/06+)	Completed
3	LVW North Lake (2006/07+)	Completed	3	Weston Rch Crown Pk (2005/06+)	Completed	3	S. Mormon Channel (2006/07#)	Not Eligible	3	Blossom Rch Wisteria (2006/07+)	Completed
4	Campus Village (2007/08+)	Completed	4	Lake Park Baker/Elm (2006/07+)	Completed	4	Lafayette Park (2006/07+)	Completed	4	Country Greens (2007/08+)	Completed
5	Oak Grove (2008/09+)	Completed	5	Victory Park Terrace (2007/08*)	In Process	5	Alpine Manor (2007/08+)	Completed	5	Pacific Oaks South (2008/0+)	Completed
6	LVW Embarcadero (2008/09+)	Completed	6	Stockton Acres (2008/09+)	Completed	6	City Homestead (2008/09+)	Completed	6	Mayfair West (2008/09+)	Completed
7	Venetian Bridg. Angelico (2009/10+)	Completed	7	Columbus Park (2008/09+)	Completed	7	Little Johns Creek (2008/09+)	Completed	7	Sherwood Manor East (2009/10+)	Completed
8	River Oaks/River Bluff (2009/10+)	Completed	8	Caldwell Village Monter. (2009/10+)	Completed	8	Calaveras Estates (2009/10+)	Completed	8	Villa Dorado (2009/10~)	Under Const
9	Stonewood Sunnyoak (2010/11*)	In Process	9	City Park Gardens (2009/10*)	Balloting	9	Villa Addition (2009/10~)	Under Const.	9	Cal-Villa Estates (2010/11*)	Balloting
10	Colonial Estates Salters (2010/11)	Waiting	10	Weston Ranch Crestmore (2010/11*)	In Process	10	Pacific Manor (2010/11*)	In Process	10	Vista North (2010/11)	Waiting
11	Colonial Est. Plantation (2011/12)	Waiting	11	Pacific Gardens (2010/11)	Waiting	11	Oakmore (2010/11)	Waiting	11	Stonehaven Manor (2011/12)	Waiting
12	Royal Oaks (2011/12)	Waiting	12	River Estates (2011/12)	Waiting	12	College View (2011/12)	Waiting	12	Westmora Terrace (2011/12)	Waiting
13	Joaquin Murietta (2012/13)	Waiting	13	Weston Ranch Latigo (2011/12)	Waiting	13	The Oaks (2011/12)	Waiting	13	Pacific Oaks Carson (2012/13)	Waiting
14	Waterford Estates (2012/13)	Waiting	14	Oxford Circle (2012/13)	Waiting	14	Nightingale Manor (2012/13)	Waiting	14	Weber Ranch (2012/13)	Waiting
15	Colonial Est. Marseille (2013/14)	Waiting	15	Tuxedo Park South (2012/13)	Waiting	15	McCloud's Addition (2012/13)	Waiting	15	Mayfair Northeast (2013/2014)	Waiting
16	Spanos Pk Black Butte (2013/14)	Waiting	16	City Park Terrace (2013/14)	Waiting	16	E. Stockton Renewal (2013/14)	Waiting	16	La Morada Adams (2013/2014)	Waiting
17	Swain Oaks Manor (2014/15)	Waiting	17	Oxford Manor (2013/14)	Waiting	17	Sunnyside Addition (2013/14)	Waiting	17	Carnelian Estates (2014/15)	Waiting
18	Stonewood Estates-Unit 11 (2014/15)	Waiting	18	Corona Acres (2014/15)	Waiting	18	The Villa (2014/15)	Waiting	18	Loch Lomond Terrace (2014/15)	Waiting
19	Western Valley Est. NW (2015/16)	Waiting	19	Weston Ranch-Ishi Goto (2014/15)	Waiting	19	Burkett Acres (2014/15)	Waiting	19	Mission Park (2015/16)	Waiting
20	LVW North Herndon (2015/16)	Waiting	20	South of Mormon Channel (2015/16)	Waiting	20	El Ricardo Terrace (2015/16)	Waiting	20	La Morada-Perino (2015/16)	Waiting
21	Oakridge (2016/17)	Waiting	21	Corona Park (2015/16)	Waiting	21	Northcrest (2015/16)	Waiting	21	San Ramon Terrace (2016/17)	Waiting
22	Venetian Gardens (2016/17)	Waiting	22	Mosswood Park (2016/17)	Waiting	22	Fremont Villas (2016/17)	Waiting	22	Holiday Park (2016/17)	Waiting
23	Lebaron Estates (2017/18)	Waiting	23	Parkview Estates (2016/17)	Waiting	23	Rancho Del Sol (2016/17)	Waiting	23	Normandy – Province (2017/18)	Waiting
24	Colonial Estates-Beaufort(2017/18)	Waiting	24	Weston Ranch Moorcroft (2017/18)	Waiting	24	Homestead Sunset (2017/18)	Waiting	24	Sierra Meadows (2017/18)	Waiting
25	Parkwoods East (2018/19)	Waiting				25	City Homestead-American (2017/18)	Waiting	25	Mayfair Northwest (2018/19)	Waiting
26	Brookside West (2018/19)	Waiting				26	Searchlight Addition (2018/19)	Waiting	26	Fox Creek (2018/19)	Waiting
27	Colonial West (2019/20)	Waiting				27	Fairview Terrace/Seven Oaks(2018/19)	Waiting	27	Kentfield (2019/2020)	Waiting
28	Colonial Estates-Richland (2019/20)	Waiting							28	Franciscan Plaza (2019/2020)	Waiting
29	Colonial Estates South (2020/21)	Waiting							29	Glenbrook Park	Waiting
30	Spanish Bay (2020/21)	Waiting									
31	Parkwoods-Heather (2021/22)	Waiting									
32	The Landing (2021/22)	Waiting									
33	Stonewood Estates-Unit 1 (2022-23)	Waiting									
34											

Highlighted neighborhoods are those scheduled to be processed in FYs 2011 and 2012

EXPERIMENT PROPOSAL

SCOPE: Six complete neighborhoods and six individual streets which have already been traffic calmed for a minimum of six months will be selected to participate in the experiment. Pre-experiment data will be collected. The signage will be removed/replaced as described below, and post-experiment data will be collected over the following six month period.

WORK PLAN: Neighborhoods which have already been traffic calmed will be identified for possible experimentation based on two criteria:

- 1) 3 or more traffic calming measures on a single street, and
- 2) Limited access points to the network of neighborhood streets
(see Attachment A).

Experiment will be conducted in two parts, before and after signage changes and consist of:

- 1) Speed surveys,
- 2) Collision statistics,
- 3) Photographic evidence of visibility, and
- 4) Resident surveys (see Attachment B).

Speed surveys will be conducted on streets and neighborhoods meeting the above criteria. Six individual streets and six complete neighborhood areas will be selected to test each requested sign. Collision reports for the test area covering the previous six-month period will be reviewed. Staff will take photos of traffic calming measures from distances of 100', 150', 200' and 250' for later comparison (example see Attachment C). During this time period, the Pre-Experiment Resident Surveys will be mailed to the residents in the original Traffic Calmed area. Residents will be given a four week time frame in which to respond.

After the four week period, new signs either "Speed Humps Ahead" for qualifying streets or "Speed Hump Area" for qualifying neighborhoods, with appropriate advisory speed sign, will be posted at each end of the qualifying street or each entrance of the qualifying neighborhood. All other signage will be removed and "BUMP" pavement markings will be placed 50 feet in advance of all speed humps, speed cushions, speed lumps, and speed tables.

After six months, speed surveys will again be conducted in the test areas, collision reports will be reviewed and new photos will be taken of traffic calming measures from distances of 100', 150', 200' and 250' to compare visibility of before and after treatments. Post-Experiment Resident Surveys will be mailed to the same residents as the Pre-Experiment Resident Surveys. The deadline will again be four weeks for returning resident surveys.

TIME PERIODS: The time line for the total experiment will be 10 to 12 months.

EVALUATION PROCEDURES: Data consisting of before and after speed surveys and before and after collision statistics will be compared to determine if the changes in the signage have had a direct effect on drivers. We expect the results to show the same or better results based on the improved visibility of the traffic calming measures. Before and after resident surveys will be compared to assess how residents perceive the effectiveness of the signage and visibility of the measures.

REPORTING: The City of Stockton agrees that a written status report will be forwarded to the California Traffic Control Devices Committee 45 days prior to each public meeting. A final report will be provided within 90 days of the terminal date of the experimentation. Within three months of the end of this

experiment, if deemed appropriate by FHWA, the experimental signs will be removed and replaced with the original W17-1 Speed Hump sign. In addition, the City will terminate the experimentation at any time that it determines significant safety concerns are directly or indirectly attributable to the experimentation.

ADMINISTRATION: This experiment is sponsored by:

City of Stockton
Public Works Department
22 E. Weber Av., 3rd Floor
Stockton, CA 95202
(209) 937-8611

and will be conducted by

Todd Greenwood, City Traffic Engineer
Shirley Arnett, Project Manger
Monique Raqueno, Project Manager
Neighborhood Traffic Management Program
City of Stockton
Public Works Department
22 E. Weber Av., 3rd Floor
Stockton, CA 95202
(209) 937-5136 or 937-8613

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**Potential Reduction in Signage on Qualifying Streets and in Qualifying Neighborhoods
Based on New Signs “Speed Humps Ahead” or “Speed Hump Area”**

Neighborhood Area	No. of Measures	Total Signs on Qualifying Street	“Speed Humps Ahead” Reduction in Signs	Total Signs Qualifying Neighborhood	Total Entrances to Neighborhood	“Speed Area” Reduction in Signs
Drant						
ss Dr	4 humps	8	6	16	2	14
y Av	4 cushions	8	6			
Av	5 humps	10	8	28	8	20
d Dr	3 cushions	6	4			
Drant						
Dr.	3 humps 1 cushion	8	6			
n Wy	3 humps	6	4			
	3 cushions	6	4	26	7	19
n Av	6 cushions	12	10	26	5	21
abarcadero Area				26	4	22
e Ln	5 cushions	10	8	24	7	17
ks/River Bluff	6 cushions	12	10	16	3	13
Leon	4 Cushions	8	6	18	5	13
Drant						
ane	4 humps	8	6			
	5 humps	10	8			
	4 humps	8	6			
in St	6 cushions	12	10			
	3 humps	6	4			
	4 humps	8	6			
Ln	5 cushions	10	8	26	3	23
	3 Cushions	6	4			
Drant						
Av	6 humps	12	10			
Av	5 humps	10	8			
v	3 humps	6	4			
l Dr	4 cushion	8	6	30	3	27
			152 Total			189 T

ATTACMENT A

Date

Resident

_____ NTMP Area

TRAFFIC CALMING REQUEST TO EXPERIMENT - RESIDENT SURVEY

The City of Stockton currently installs Traffic Calming warning signs as required by Federal and State agencies. In some neighborhoods where multiple traffic calming measures have been installed, residents have complained about too many signs negatively affecting the overall appearance of their neighborhood.

As a possible solution to this concern, the City of Stockton has petitioned to conduct an experiment to test other signs and at the same time make the measures more visible to drivers.

Your neighborhood has been identified as having three or more traffic calming measures on a single street or limited entrances to the network of neighborhood streets. We are asking for your assistance in determining the effectiveness of the new signs compared to the signs we currently use. Please complete the enclosed survey and return to the City of Stockton, Public Works Department in the enclosed Business Reply Mail envelope before _____, 2011.

After that date, many of the existing signs in your neighborhood will be removed and replaced with retroreflective "BUMP" pavement markings on the roadway before each measure. After an appropriate test period, you will be asked to complete another resident survey. Results of this survey will help the City and the Federal and State agencies determine if the new signs should be included in future traffic calming programs.

Thank you for your assistance in this experiment. If you have any questions or would like additional information, please contact the Neighborhood Traffic Management Program Coordinators at either (209) 937-5136 or (209) 937-8613.

ROBERT MURDOCH, DIRECTOR
PUBLIC WORKS DEPARTMENT

TODD W. GREENWOOD
CITY TRAFFIC ENGINEER

RKM:TWG:sa

Enclosure: Pre-Experiment Resident Survey

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ATTACHMENT B

PRE-EXPERIMENT RESIDENT SURVEY

Please respond to each of the following items using a scale of **1 to 5**, where **1** you least agree and **5** you most agree.

- 1) Traffic calming has been effective at slowing traffic in my neighborhood.
1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 2) Traffic calming has eliminated cut-through traffic in my neighborhood.
1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 3) Children and pedestrians are safer in my neighborhood since traffic calming.
1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 4) I easily notice the speed hump warning signs in my neighborhood?
1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 5) There are too many speed hump warning signs in my neighborhood or on my street.
1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 6) The number of signs on my street detracts from the overall appearance of my neighborhood.
1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 7) I have trouble seeing the speed humps/cushions in my neighborhood.
1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 8) I notice other drivers seem to have trouble seeing the speed humps/cushions in my neighborhood. (They are caught off guard.)
1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 9) I would like more traffic calming measures in my neighborhood.
1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

Please use the enclosed postage-paid Business Reply Mail envelope to return this survey to the City of Stockton, Public Works Department.

Thank you very much for responding to this survey.

CITY OF STOCKTON PUBLIC WORKS DEPARTMENT
NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM

ATTACHMENT B

Date

Resident

_____ NTMP Area

TRAFFIC CALMING REQUEST TO EXPERIMENT - RESIDENT SURVEY

Your neighborhood has been participating in an experiment with the City of Stockton to test new Traffic Calming warning signs and markings. Several months ago you completed a Pre-Experiment Survey to let us know how well you thought the previous signs and markings were working and how they affected the appearance of your neighborhood.

The new signs and markings have been in place for at least six months. We would now like your responses on the enclosed Resident Survey. Responses from both the Pre-Experiment Surveys and Post-Experiment Surveys will be compared to determine if there have been any significant changes or improvements. These results will be compared with other data the City has collected including speed surveys and collision reports, to determine if the new signage can be included in future traffic calming programs.

We appreciate you taking the time to help with our study. Please let us know if you have any questions or would like any additional information by calling our Neighborhood Traffic Management Program Coordinators at (209) 937-5136 or (209) 937-8613.

ROBERT MURDOCH, DIRECTOR
PUBLIC WORKS DEPARTMENT

TODD W. GREENWOOD
CITY TRAFFIC ENGINEER

RKM:TWG:sa

Enclosure: Post-Experiment Resident Survey

ATTACHMENT B

POST-EXPERIMENT RESIDENT SURVEY

Please respond to each of the following items using a scale of **1 to 5**, where **1** you least agree and **5** you most agree.

- 1) Changes to the warning signs and adding pavement markings have made traffic calming more effective at slowing traffic in my neighborhood.
- 1 ☐ 2 ☐ 3 ☒ 4 ☐ 5 ☐
- 2) Cut-through traffic is no different since changes were made to the traffic calming signs and markings.
- 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 3) Children and pedestrians are safer in my neighborhood since the traffic calming signs and markings were changed.
- 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 4) The warning signs at the beginning of the street or at the entrance to my neighborhood are much more visible than before.
- 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 5) There are not enough speed hump warning signs in my neighborhood or on my street.
- 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 6) The overall appearance of my neighborhood has improved with the removal of extra traffic calming warning signs.
- 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 7) The speed humps/cushions in my neighborhood are much more noticeable with pavement markings.
- 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 8) Other drivers seem more observant of speed humps/cushions in my neighborhood. (They are no longer caught off-guard.)
- 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
- 9) I don't notice any significant changes to traffic in my neighborhood since warning signs and markings were changed.
- 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

Please use the enclosed postage-paid Business Reply Mail envelope to return this survey to the City of Stockton, Public Works Department.

Thank you for your assistance with our experiment by responding to this survey.

CITY OF STOCKTON PUBLIC WORKS DEPARTMENT
NEIGHBORHOOD TRAFFIC MANAGEMENT PROGRAM

ATTACHMENT B

Speed Hump Visibility
100' Distance



11-3 Request to Experiment with Buffered Bicycle Lanes on 2nd St. between Bayshore Dr. & PCH in Naples

Proposal: City of Long Beach request authorization to conduct an experiment with Buffered Bicycle Lanes.

Agency Making Request: City of Long Beach

Sponsor: John Fisher, CTCDC member representing Southern CA Cities



CITY OF LONG BEACH

DEPARTMENT OF PUBLIC WORKS

333 WEST OCEAN BOULEVARD • LONG BEACH, CA 90802 • (562) 570-6383 • FAX (562) 570-6012

December 8, 2010

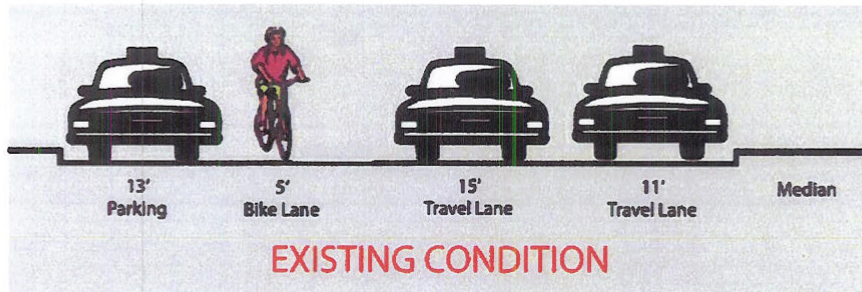
Mr. John Fisher
Member, California Traffic Control Devices Committee
C/o City of Los Angeles
Department of Transportation
100 S. Main St., 10th Floor
Los Angeles, CA 90012

Subject: Request CTCDC's Review and Approval of the Proposed Buffered Bicycle Lanes in the City of Long Beach

Dear Mr. Fisher:

The City of Long Beach is seeking approval from CTCDC to provide a buffered bicycle lane on the south side of 2nd Street in the City of Long Beach. The City submitted a Request to Experiment with Buffered Bicycle Lanes to FHWA in August 2010 and subsequently obtained the FHWA approval in October, 2010. Attachment A is the city's request and the response letter from FHWA.

Buffered bicycle lanes are intended for areas where the width available to provide a bicycle lane is relatively wide, typically more than 8 feet. The buffer provides for optimal use of the space, assuring better separation between bicyclists and motorists, plus optimal separation from the door zone resulting from parked vehicles. The design should thus result in improved safety and enhanced service to bicyclists by reducing the potential affects of riding close to moving or parked vehicles. In the case of this particular roadway, there is a 13' separation existing between the parked cars and the bike lane, so the buffer is proposed to separate bicyclists and motorists.



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Long Beach, CA 90806
Ph. (562) 570-2850
Fax (562) 570-2861

FLEET SERVICES
2600 Temple Avenue
Long Beach, CA 90806
Ph. (562) 570-5400
Fax (562) 570-5414

PUBLIC SERVICE
1601 San Francisco Avenue
Long Beach, CA 90813
Ph. (562) 570-2762
Fax (562) 570-2729

Use of buffered bicycle lane striping treatments in California may pose some special logistical challenges. The California Vehicle Code (CVC Section #21651) specifically indicates that motorists may not cross two solid parallel lines more than two feet apart. The clause appears to be intended for median striping, but our state law does not specify that the parallel stripes must be yellow. It has thus been interpreted that the use of two or three solid lines parallel may not be allowed for access to parking without violating the CVC. A discussion of how to avoid a possible conflict with this section of the CVC is included in Attachment B.

This request was presented to the California Bicycle Advisory Committee (CBAC) on October 7, 2010. Members asked for possible design treatments as well as proposed treatment at intersections, which are included in Attachment C. These concepts were presented for discussion at the CBAC on December 2, 2010.

The City of Long Beach has established a research plan to test the comprehension of the buffered bicycle lane striping among motorists and bicyclists. The semiannual progress report and final evaluation report at the end of the study period will be submitted to FHWA and to the CTCDC for review.

Before Study:

- Existing Facility Bicycle Usage
- Location within the roadway where bicycle usage is occurring
- Existing Safety Record

After Study:

- Change in Usage of the Facility
- Compliance with lane markings
- Motorists understanding of markings with respect to parallel parking
- Changes in Safety Record and potential relationship to striping change
- Attitude of Motorists and bicyclists toward changes following Implementation

When the buffered bike lane is initially installed, cyclist and motorist behavior will be observed for a three-day period to determine their understanding of and compliance with the lane markings. Motorists will also be observed to note any reluctance to cross the buffer to access on street parking as intended. Motorists and cyclists will also be interviewed to determine their attitudes toward these changes during this initial period, and as a part of the semi-annual progress report and final evaluation report.

Per your request, a formal experimentation request, as shown on the CTCDC website is enclosed in Attachment D.

With your concurrence, the City will send representatives to the meeting to present information on this proposal and answer any questions the CTCDC may

have. Please contact me at (562) 570-6771 if you have any questions regarding this request.

Sincerely,



Mark Christoffels
Deputy Director of Public Works/City Engineer

Attachment A: FHWA RTE Request and Approval
Attachment B:

Cc: Sumire Gant
David Roseman
Steve Tweed
Min Zhou, KOA

ATTACHMENT A**FHWA RTE REQUEST AND APPROVAL LETTER****CITY OF LONG BEACH**

DEPARTMENT OF PUBLIC WORKS

333 WEST OCEAN BOULEVARD • LONG BEACH, CA 90802 • (562) 570-6383 • FAX (562) 570-6012

August 17, 2010

Mr. Bruce Friedman
Federal Highway Administration
Office of Transportation Operations
400 Seventh Street, SW, HOTO
Washington, DC 20590

Dear Mr. Friedman:

Request to Experiment with Buffered Bicycle Lanes in Long Beach

The City of Long Beach is seeking approval of a Request to Experiment to provide for buffered bicycle lanes on 2nd Street in the City of Long Beach. Buffered bicycle lanes are intended for areas where the width available to provide a bicycle lane is relatively wide, typically more than 8 feet. The buffer provides for optimal use of the space, assuring better separation between bicyclists and motorists, plus optimal separation from the door zone resulting from parked vehicles. The design should thus result in improved safety and enhanced service to bicyclists by reducing the potential affects of riding close to moving or parked vehicles.

The potential for a buffered bicycle lane exists adjacent to parallel parking. Under this condition, it is proposed that bicycle lanes be striped with a striping treatment that would generally consist of three linear stripes, including one stripe that designates the edge line for the motor vehicle travel way, and two stripes that designate the left edge and right edge of the desired lateral placement for the bicycle lane. The left edge for the bicycle lane provides for a comfortable buffer zone between the motor vehicle travel lane and the bicycle lane. The right edge provides for a comfortable buffer between the bicyclist and the door zone for parked vehicles. Performance criteria would be similar to the condition where parking is not allowed, except motorist understanding of permissive ability to cross the buffer to enter parking and driveways will be a more significant effect.

The City is aware that a number of other communities throughout the U.S. are currently experimenting with buffered bicycle lanes. The city wishes to join with these other communities to test the treatment.

Use of buffered bicycle lane striping treatments in California may pose some special logistical challenges. The California Vehicle Code (CVC Section #21651) specifically indicates that motorists may not cross two solid parallel lines more than two feet apart. The clause appears to be intended for median striping, but our state law does not specify that the parallel stripes must be yellow. It has thus been interpreted that the use of two or three solid lines parallel may be not allowed for access to parking without violating the CVC. For this reason, it will be necessary for the proposed markings to not consist of parallel solid stripes. We will propose a treatment that has been used in New York City or a variant used in Portland, OR (see Exhibit A), where

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Fax (562) 570-5414

PUBLIC SERVICE
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Fax (562) 570-2729

Mr. Bruce Friedman
August 17, 2010
Page 2

the left edge line for the bicycle lane is a skip line with lateral or angled connections to the motor vehicle right edge line. We specifically propose to use a white stripe that is 6-inches wide (the width of a California bicycle lane stripe) and painted for approximately 25% of the centerline distance with a gap for 75% of the distance. This skip stripe will be connected to the adjacent bicycle lane stripe by a diagonal or chevron shaped 4" white line, one connecting stripe per painted segment. We will examine a 2-foot painted, 6-foot gap, or a 3-foot painted 9-foot gap based upon their optical effect and make a final decision, or we may use one stripe interval on the easterly ¼ mile segment and another interval on the westerly ¼ mile segment to compare effectiveness. The City will consider other treatments if they offer more promise from current experiments and are in compliance with CVC. We will share any revised striping approach with you for further thought and concurrence.

The proposed request thus requires the use of a non-standard stripe treatment or a combination of standard striping treatments that are not provided by the MUTCD. The type of striping to be used would be the subject of the Request To Experiment (RTE). We believe that other communities are currently experimenting with buffered bicycle lanes, but we do not know if any of these experiments are guided by FHWA RTE's. We are also unaware of any concerns or issues that have arisen from these early implementations.

The research plan is defined as follows:

Before Study:

- Existing Facility Bicycle Usage
- Location within the roadway where bicycle usage is occurring
- Existing Safety Record

After Study:

- Change in Usage of the Facility
- Compliance with lane markings
- Motorists understanding of markings with respect to parallel parking
- Changes in Safety Record and potential relationship to striping change
- Attitude toward Changes following Implementation

The City of Long Beach certifies that the concept of this traffic control device is not protected by a patent or copyright. The City also agrees to restore the experimental site to a condition that complies with the provisions of the MUTCD within 3 months following the completion of the experiment. The City will also terminate the experiment if it is determined by the City or by FHWA that the experiment directly or indirectly causes significant safety hazards. If the experiment demonstrates an improvement, the application will remain in place as a request is made to update the MUTCD and an official rulemaking action occurs. The City also agrees to provide semiannual progress reports for the duration of the experimentation and to provide a copy of the final results to FHWA within three months of the conclusion of the experiment; also, FHWA may terminate approval of the experimentation if these reports are not provided on schedule.

The City proposes to conduct the experiment adjacent to parallel parking on Second Street eastbound between Bay Shore Avenue and Applan Way. This location is very close to the site of an approved RTE for the Second Street Green Sharrow lane project, and it is also near the site of a pending request to demonstrate a bicycle box treatment.

Mr. Bruce Friedman
August 17, 2010
Page 3

Please advise if a Request to Experiment will be acceptable. The City of Long Beach appreciates the past approvals by FHWA for experimentation with bicycle facilities and looks forward to our approval of this request.

Sincerely,



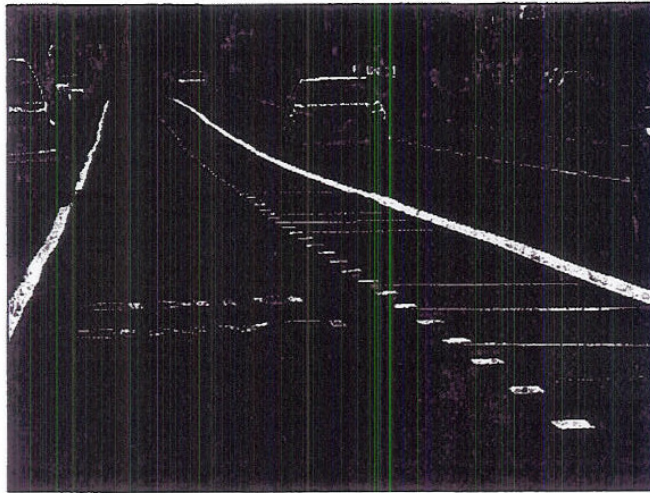
MARK CHRISTOFFELS
DEPUTY DIRECTOR OF PUBLIC WORKS/CITY ENGINEER

MC:SG:db
P:T&TCorres.RTEBuffered

cc: Councilmember Gary DeLong
Michael Conway, Director of Public Works
David Roseman, City Traffic Engineer
Sumire Gant, Transportation Programs Officer
Rock Miller, KOA

Mr. Bruce Friedman
August 17, 2010
Page 4

EXHIBIT A





U.S. Department
of Transportation
Federal Highway
Administration

1200 New Jersey Avenue, SE
Washington, D.C. 20590

OCT - 6 2010

In Reply Refer To:
HOTO-1

Mark Christoffels, P.E.
Deputy Director of Public Works/City Engineer
City of Long Beach
Department of Public Works
333 West Ocean Boulevard
Long Beach, CA 90802

Dear Mr. Christoffels:

Thank you for your August 17 letter requesting permission to experiment with buffered bike lanes on 2nd Street between Bay Shore Avenue and Appian Way in the City of Long Beach.

We have reviewed your request and have concluded that the only experimental aspect of your project is the pavement marking pattern that is associated with the buffer area.

Your request to experiment is approved, and we look forward to receiving your semiannual progress reports and your final evaluation report at the end of the study period. For recordkeeping purposes, we have assigned the following official experimentation number and title: "9(09)-10 (E) - Buffered Bike Lanes - Long Beach, CA." Please refer to this number in future correspondence.

Thank you for your interest in improving the operational capability and traffic safety for bicyclists through the use of buffered bike lanes.

Sincerely yours,


for Mark R. Kebri
Director, Office of Transportation
Operations



ATTACHMENT B

DISCUSSION OF CONFLICT WITH CVC SECTION 21651

A discussion of how to avoid a possible conflict between the California Vehicle Code Section #21651

City of Long Beach: Request to experiment with a buffered bike lane on Second Street between Bayshore Drive and Pacific Coast Highway in Naples

Long Beach proposal

The City is proposing to experiment with the use of pavement markings to buffer and better delineate a bike lane on Second Street between Bayshore Drive and Pacific Coast Highway in a commercial area in the southeast area of Long Beach known as Naples. At issue is the width of that bike lane. Today we have an existing standard 5' bike lane (double parallel lines) currently marked adjacent to a 15' outside travel lane (#2) that was recently resurfaced.

The City would like to add a 4' buffer section with diagonal hatched lines to delineate the buffer zone. The buffer would serve two purposes. The buffer will utilize 4' of roadway from the outside (#2) travel lane reducing the existing lane width from 15' to 11' resulting in a speed reduction by adding a traffic calming affect in the form of a road diet. Secondly, the buffer provides an additional 4' of space between the travel lane and the existing bike lane adding in a safety margin between motor vehicles and cyclists. As planned, the bike lane would be a total of 9' wide from solid edge line to solid edge line.

We are proposing that our Request To Experiment (RTE) should fall under the design criteria of a very wide (9') bike lane. This wide bike lane is comprised of (2) solid 6" white edge lines delineating the outside edges of the bike lane, with a 4' buffer zone with 6" white diagonal hatching separated by a 6" white broken line between the (2) 6" white solid parallel lines. In this case we propose a continuous 9' bike lane that has (2) solid white parallel 6" lines. This 9' bike lane is then split into a standard 5' bike lane (bottom portion of the 9' bike lane) and a 4' buffered area with diagonal hatching (top portion of the 9' bike lane) and the line separating the buffer and the bike lane is a broken line.

Under this arrangement the buffered bike lane and the standard bike lane are seen as one 9' installation, not two separate items as today with a 5' bike lane and a proposed 4' buffer zone. (Please refer to Concept C). We argue that under this arrangement the buffered bike lane can be traversed in the same manner as one does today to either park or to enter or leave the roadway as defined in CVC Section 21209 below.

The existing CVC section 21651 reads as follows:

V C Section 21651 Divided Highways

Divided Highways

21651. (a) Whenever a highway has been divided into two or more roadways by means of intermittent barriers or by means of a dividing section of not less than two feet in width, either unpaved or delineated by curbs, double-parallel lines, or other markings on the roadway, it is unlawful to do either of the following:

(1) To drive any vehicle over, upon, or across the dividing section.

(2) To make any left, semicircular, or U-turn with the vehicle on the divided highway, except through an opening in the barrier designated and intended by public authorities for the use of vehicles or through a plainly marked opening in the dividing section.

(b) It is unlawful to drive any vehicle upon a highway, except to the right of an intermittent barrier or a dividing section which separates two or more opposing lanes of traffic. Except as otherwise provided in subdivision (c), a violation of this subdivision is a misdemeanor.

(c) Any willful violation of subdivision (b) which results in injury to, or death of, a person shall be punished by imprisonment in the state prison, or imprisonment in a county jail for a period of not more than six months.

Amended Ch. 765, Stats. 1988. Effective January 1, 1989.

The existing CVC section 21651 as stated above, does not allow for a motor vehicle to drive over or upon double-parallel lines.

- Now, refer to CVC Section 21209 below as it relates to motor vehicles in bike lanes. This code language allows for motor vehicles to cross over an existing bike lane to park.

V C Section 21209 Motor Vehicles and Motorized Bicycles in Bicycle Lanes

Motor Vehicles and Motorized Bicycles in Bicycle Lanes

21209. (a) No person shall drive a motor vehicle in a bicycle lane established on a roadway pursuant to Section 21207 except as follows:

(1) To park where parking is permitted.

(2) To enter or leave the roadway.

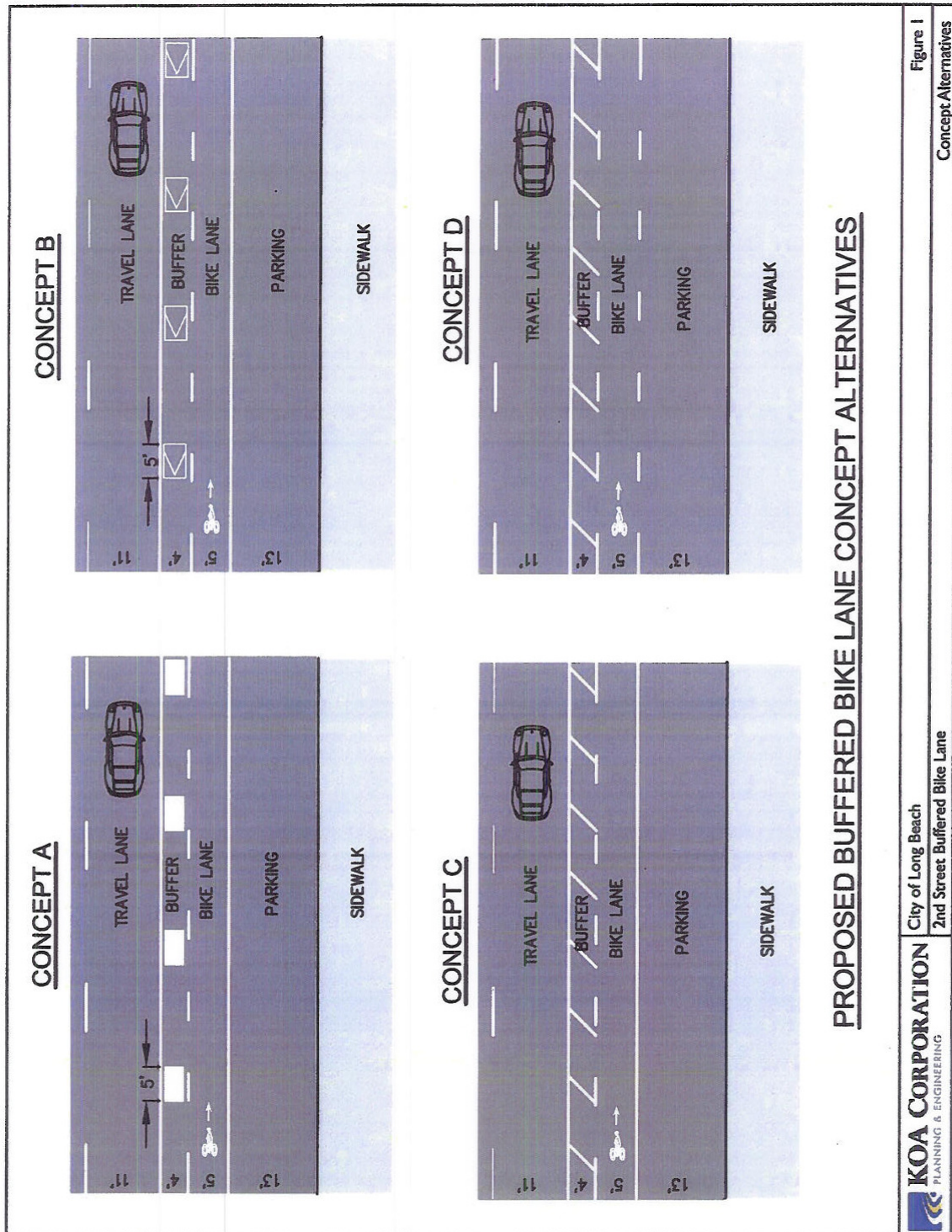
(3) To prepare for a turn within a distance of 200 feet from the intersection.

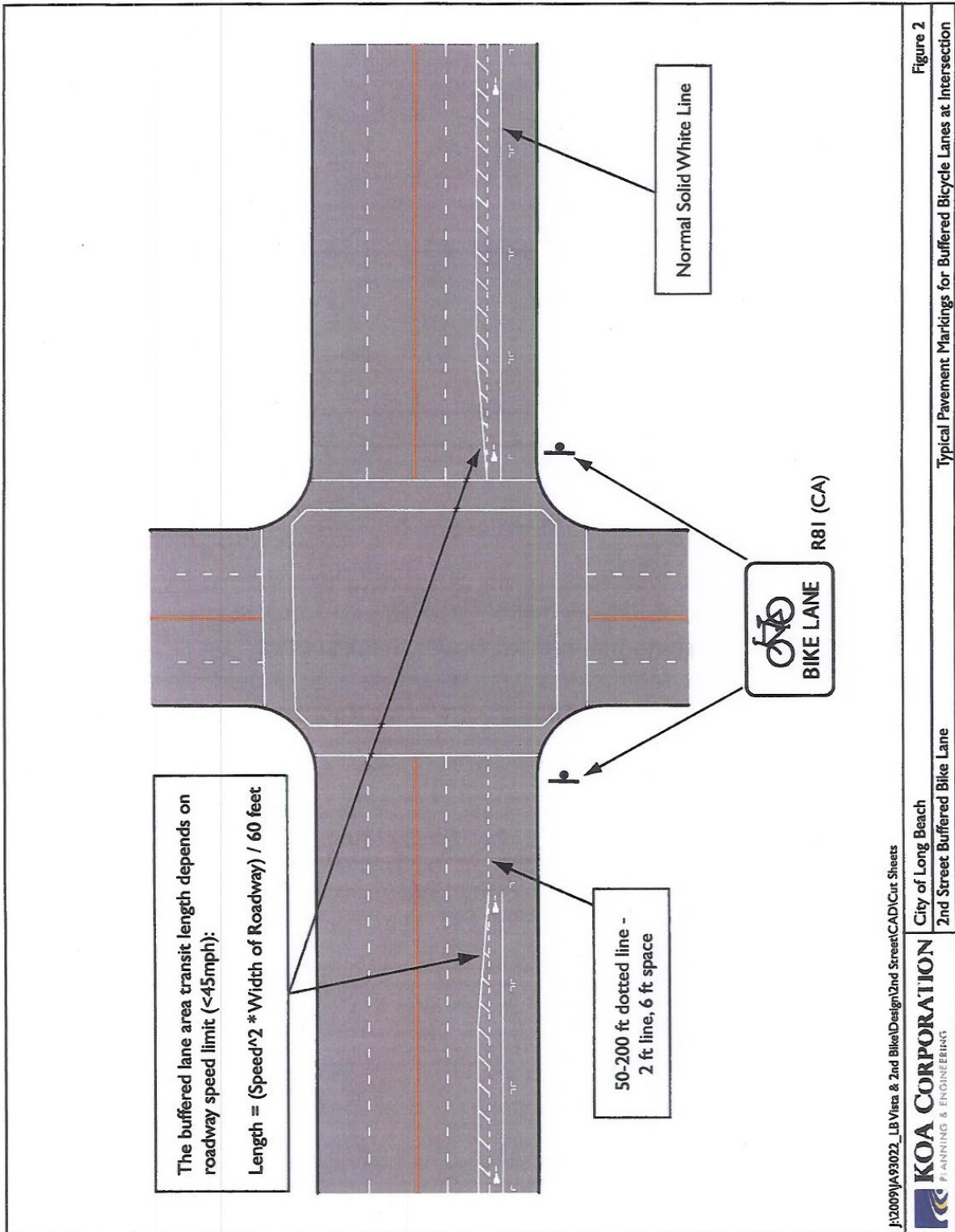
(b) This section does not prohibit the use of a motorized bicycle in a bicycle lane, pursuant to Section 21207.5, at a speed no greater than is reasonable or prudent, having due regard for visibility, traffic conditions, and the condition of the roadway surface of the bicycle lane, and in a manner which does not endanger the safety of bicyclists.

Amended Ch. 262, Stats. 1988. Effective January 1, 1989.

ATTACHMENT C

BUFFERED LANE TREATMENT ALTERNATIVES





**CTCDC
STATUS OF EXPERIMENT**

Date DECEMBER 8, 2010

Item _____ Experiment BUFFERED BIKE LANE

Sponsor CITY OF LONG BEACH

Supporting Agency & Contact CITY OF LONG BEACH

STEVE TWEED, TRANSPORTATION PLANNER

Next Appearance Before the CTCDC FEBRUARY 2, 2011

Milestones 1. REMOVE TRAVEL LANE 5. SEEK CBAC &
2. RESURFACE ROADWAY CTCDC & FHWA APPROVALS
3. PRE-MARK STRIPING TO EXPERIMENT
4. PAINT 5' BIKE LANE 6. APPLY BUFFER &
REPORT FINDINGS

Status AWAITING APPROVAL OF THE
CBAC & CTCDC TO IMPLEMENT
APPROVED PAVEMENT MARKINGS TO
INDICATE "BUFFER ZONE" ADJACENT
TO EXISTING 5' BIKE LANE.

Applicant's Signature Stephen R. Tweed

Applicant's Name STEPHEN R. TWEED

Address 333 W. OCEAN BLVD, 10TH FLOOR, LONG BEACH

Phone 562-570-6266 FAX 562-570-7161 9802

11-4 Request for Permission to Experiment-Rectangular Rapid Flashing Beacon

Proposal: City of Santa Monica request authorization to conduct an experiment with Rectangular Rapid Flashing Beacon.

Agency Making Request: City of Santa Monica

Sponsor: John Fisher, CTCDC member representing Southern CA Cities



Planning & Community Development Department
Transportation Engineering Group
1685 Main Street, Room 115
Santa Monica, CA 90401

December 8, 2010

Mr. Devinder Singh, Executive Secretary
California Traffic Control Devices Committee – MS36
P.O. Box 942874
Sacramento, CA 94274-0001

SUBJECT: Request for Permission to Experiment – Rectangular Rapid Flashing Beacon

Dear Mr. Singh / CTCDC Committee:

The City of Santa Monica requests permission to conduct an experiment using the Rectangular Rapid Flashing Beacons (RRFB), a device which received interim approval from the Federal Highway Administration (FHWA) in 2008 and has yet to be approved for use in the State of California. The purpose of the experiment will be to determine the effectiveness of RRFB in increasing driver awareness and yielding compliance to pedestrians crossing the street at uncontrolled marked crosswalk locations.

1. Problem Statement

The City of Santa Monica is seeking a solution to increase driver awareness and crosswalk compliance at uncontrolled marked crosswalk locations. Like many jurisdictions throughout the State and nation, Santa Monica is concerned with crosswalk compliance and ensuring that motorists yield right-of-way to pedestrians in uncontrolled marked crosswalk locations. Crosswalk compliance is especially important on multi-lane roadways where "multiple threat" situations exist. To address crosswalk compliance, the City has pursued a number of available treatments and/or traffic control devices designed to either bring attention to the crosswalk from the motorists' perspective or educate them of State law which requires motorists to yield to pedestrians in a crosswalk. The treatments employed by the City include In-Roadway Warning Lights (IRWL), flashing beacons, signage treatments, and various high visibility crosswalk striping treatments combined with warning signs, advanced warning signs, advanced yield markings, pedestrian refuge islands, and curb extensions.

Request for Permission to Experiment – Rectangular Rapid Flashing Beacon
December 8, 2010
Page 2 of 9

2. Proposed Change

To increase driver awareness at uncontrolled crosswalks, and increase crosswalk compliance rates, the use of RRFB is proposed to supplement standard pedestrian crossing warning signs. The RRFB operates similarly to standard warning beacons or in-roadway warning lights (IRWL). The device will be installed on roadside poles, and would remain dark until a pedestrian activates the system by pressing a pushbutton. Once the system is activated, the RRFB uses rectangular-shaped high-intensity LED-based indications that flash rapidly in a wig-wag "flickering" flash pattern, and are mounted immediately between the crossing sign and the sign's supplemental arrow plaque. The device employs yellow LED RRFBs that are similar in operation to emergency flashers on police vehicles. The system will also provide an additional flashing amber light which indicates to the pedestrian the system is active.

For the purpose of this experiment, a standard flashing beacon as defined in the CA MUTCD will be modified with high intensity lights that operate using the RRFB rapid flash pattern, for comparative analysis with the RRFB. The two alternatives will be tested independently at the same location.

Testing Location

The devices will be tested in the City of Santa Monica at the intersection of Santa Monica Boulevard and Princeton Street. The test location consists of a marked crosswalk across Santa Monica Boulevard on the uncontrolled eastern leg of the intersection. Santa Monica Boulevard is a major boulevard that generally runs east-west. Stop controls are provided on Princeton Street, which is the minor side street approach to Santa Monica Boulevard. The intersection is offset, with the segment of Princeton Street south of Santa Monica Boulevard located approximately 30 feet west of the segment to the north. Traffic counts collected by the City in 2006 indicate that Santa Monica Boulevard has an Average Daily Traffic Volume (ADT) of about 28,200 vehicles, with a p.m. peak hour count of approximately 2,030 vehicles. The posted speed limit on Santa Monica Boulevard is 30 mph. In the five-year period between 2003 and 2008 there were two accidents involving pedestrians at this location. Both accidents occurred during daytime conditions with the pedestrians in the crosswalks, with one accident classified as a hit-and-run.

3. Device Information

The RRFB was developed by a vendor in conjunction with the City of St. Petersburg, Florida. As described above, the RRFB uses rectangular-shaped high-intensity LED-based indications, flashes rapidly in a wig-wag "flickering" flash pattern, and is mounted immediately between the crossing sign and the sign's supplemental arrow plaque. The device employs yellow LED RRFBs that

Request for Permission to Experiment – Rectangular Rapid Flashing Beacon
December 8, 2010
Page 3 of 9

are similar in operation to emergency flashers on police vehicles. The RRFB operates similarly to standard warning beacons or in-roadway warning lights (IRWL). Installed on roadside poles, the RRFB remains dark until a pedestrian activates the system by pressing a pushbutton. Once the system is activated, the RRFB uses rectangular-shaped high-intensity LED-based indications that flash rapidly in a wig-wag "flickering" flash pattern. The system also provides an additional flashing amber light which indicates to the pedestrian the system is active.

In 2008, the RRFB was approved for interim use at the Federal level by the FHWA. The Signals Technical Committee voted to endorse the future inclusion of the RRFB for uncontrolled crosswalks into the MUTCD and recommended that FHWA issue an interim approval for RRFB. The interim approval includes a number of provisions for the design and use of the RRFB. These provisions are listed below and would guide the use of the device for the experimentation process.



Sample Rectangular Rapid Flashing Beacon

1. General Conditions:

- a. An RRFB shall consist of two rapidly and alternately flashed rectangular yellow indications having LED-array based pulsing light sources, and shall be designed, located, and operated in accordance with the detailed requirements specified below.
- b. The use of RRFBs is optional. However, if an agency opts to use an RRFB under this Interim Approval, the following design and operational requirements shall apply, and shall take precedence over any conflicting provisions of the MUTCD for the approach on which RRFBs are used:

2. Allowable Uses:

- a. An RRFB shall only be installed to function as a Warning Beacon (see 2003 MUTCD Section 4K.03).
- b. An RRFB shall only be used to supplement a W11-2 (Pedestrian) or S1-1 (School) crossing warning sign with a

Request for Permission to Experiment – Rectangular Rapid Flashing Beacon
December 8, 2010
Page 4 of 9

diagonal downward arrow (W16-7p) plaque, located at or immediately adjacent to a marked crosswalk.

- c. An RRFB shall not be used for crosswalks across approaches controlled by YIELD signs, STOP signs, or traffic control signals. This prohibition is not applicable to a crosswalk across the approach to and/or egress from a roundabout.
- d. In the event sight distance approaching the crosswalk at which RRFBs are used is less than deemed necessary by the engineer, an additional RRFB may be installed on that approach in advance of the crosswalk, as a Warning Beacon to supplement a W11-2 (Pedestrian) or S1-1 (School) crossing warning sign with an AHEAD: (W16-9p) plaque. This additional RRFB shall be supplemental to and not a replacement for RRFBs at the crosswalk itself.

3. Sign/Beacon Assembly Locations:

- a. For any approach on which RRFBs are used, two W11-2 or S1-1 crossing warning signs (each with RRFB and W16-7p plaque) shall be installed at the crosswalk, one on the right-hand side of the roadway and one on the left-hand side of the roadway. On a divided highway, the left-hand side assembly should be installed on the median, if practical, rather than on the far left side of the highway.
- b. An RRFB shall not be installed independent of the crossing signs for the approach the RRFB faces. The RRFB shall be installed on the same support as the associated W11-2 (Pedestrian) or S1-1 (School) crossing warning sign and plaque.

4. Beacon Dimensions and Placement in Sign Assembly:

- a. Each RRFB shall consist of two rectangular-shaped yellow indications, each with an LED-array based light source. Each RRFB indication shall be a minimum of approximately 5 inches wide by approximately 2 inches high.
- b. The two RRFB indications shall be aligned horizontally, with the longer dimension horizontal and with a minimum space between the two indications of approximately seven inches (7 in), measured from inside edge of one indication to inside edge of the other indication.

Request for Permission to Experiment – Rectangular Rapid Flashing Beacon
December 8, 2010
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- c. The outside edges of the RRFB indications, including any housings, shall not project beyond the outside edges of the W11-2 or S1-1 sign.
- d. As a specific exception to 2003 MUTCD Section 4K.01 guidance, the RRFB shall be located between the bottom of the crossing warning sign and the top of the supplemental downward diagonal arrow plaque (or, in the case of a supplemental advance sign, the AHEAD plaque), rather than 12 inches above or below the sign assembly.

5. Beacon Flashing Requirements:

- a. When activated, the two yellow indications in each RRFB shall flash in a rapidly alternating "wig-wag" flashing sequence (left light on, then right light on).
- b. As a specific exception to 2003 MUTCD Section 4K.01 requirements for the flash rate of beacons, RRFBs shall use a much faster flash rate. Each of the two yellow indications of an RRFB shall have 70 to 80 periods of flashing per minute and shall have alternating but approximately equal periods of rapid pulsing light emissions and dark operation. During each of its 70 to 80 flashing periods per minute, one of the yellow indications shall emit two rapid pulses of light and the other yellow indication shall emit three rapid pulses of light.
- c. The flash rate of each individual yellow indication, as applied over the full on-off sequence of a flashing period of the indication, shall not be between 5 and 30 flashes per second, to avoid frequencies that might cause seizures.
- d. The light intensity of the yellow indications shall meet the minimum specifications of Society of Automotive Engineers (SAE) standard J595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles) dated January 2005.

6. Beacon Operation:

- a. The RRFB shall be normally dark, shall initiate operation only upon pedestrian actuation, and shall cease operation at a predetermined time after the pedestrian actuation or, with passive detection, after the pedestrian clears the crosswalk.

Request for Permission to Experiment – Rectangular Rapid Flashing Beacon
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- b. All RRFBs associated with a given crosswalk (including those with an advance crossing sign, if used) shall, when activated, simultaneously commence operation of their alternating rapid flashing indications and shall cease operation simultaneously.
- c. If pedestrian pushbuttons (rather than passive detection) are used to actuate the RRFBs, a pedestrian instruction sign with the legend PUSH BUTTON TO TURN ON WARNING LIGHTS should be mounted adjacent to or integral with each pedestrian pushbutton.
- d. The duration of a predetermined period of operation of the RRFBs following each actuation should be based on the MUTCD procedures for timing of pedestrian clearance times for pedestrian signals.
- e. A small light directed at and visible to pedestrians in the crosswalk may be installed integral to the RRFB or push button to give confirmation that the RRFB is in operation.

While the FHWA has issued an interim approval allowing blanket use of the device, the RRFB does not meet the current standards for flashing warning beacons as contained in the 2009 edition of the CA MUTCD, Chapter 4L which requires a warning beacon to be round in shape and either 8 or 12 inches in diameter, to flash at a rate of approximately once per second, and to be located no less than 12 inches outside the nearest edge of the warning sign it supplements. The RRFB uses rectangular-shaped high-intensity LED-based indications, flashes rapidly in a wig-wag "flickering" flash pattern, and is mounted immediately between the crossing sign and the sign's supplemental arrow plaque.

The interim approval was brought before the California Traffic Control Devices Committee (CTCDC) at its September 2008 meeting, agenda item # 08-25. The CTCDC recommended not adopting the FHWA interim approval in California, instead the Committee encouraged agencies to seek approval from the CTCDC and test multiple devices based on the premise that "if other devices are equally effective, then why limit to a particular shape and size as issued in the interim approval by the FHWA".

4. Supporting Data

A 2010 Transportation Research Board Report, *Effects of Yellow Rectangular Rapid-Flashing Beacons on Yielding at Multilane Uncontrolled Crosswalks* examined the effects of the RRFB at uncontrolled marked crosswalks. The report noted that several methods have been examined through national testing to increase driver yield response rates to pedestrians at multilane crosswalks at

Request for Permission to Experiment – Rectangular Rapid Flashing Beacon
December 8, 2010
Page 7 of 9

uncontrolled marked locations along arterials with relatively high average daily traffic, and that “previously, only treatments that employed a red phase have consistently produced sustained high levels of yielding at high-volume multilane crosswalks”.

The report examined a series of five experiments that evaluated the efficacy of RRFBs. These studies found that RRFBs produced an increase in yielding behavior at all 22 sites located in 3 cities in the United States. Further, data collected over a 2-year follow-up period at 18 of these sites also documented the long-term maintenance of yielding produced by RRFBs. A comparison of RRFBs to a traditional overhead yellow flashing beacon and a side-mounted traditional yellow flashing beacon documented higher driver yielding associated with RRFBs that was not only statistically significant, but also practically important. Data from other experiments demonstrated that mounting additional beacons on pedestrian refuge islands, or medians, and aiming the beacons to maximize its salience at the dilemma zone increased the efficacy of the system, while two other variants were not found to influence the effectiveness of the system¹.

Further, the FHWA's Office of Transportation Operations has reviewed the available data and considers the RRFB to be highly successful for the applications tested (uncontrolled marked crosswalks). “The RRFB offers significant potential safety and cost benefits; because it achieves very high rates of compliance at a very low relative cost in comparison to other more restrictive devices that provide comparable results, such as full midblock signalization.” The FHWA believes that the RRFB has a low risk of safety or operational concerns. However, because proliferation of RRFBs in the roadway environment to the point that they become ubiquitous could decrease their effectiveness, use of RRFBs should be limited to locations with the most critical safety concerns, such as pedestrian and school crosswalks across uncontrolled approaches, as tested in the experimentation.

5. Experiment Scope

The objective of this experiment is to evaluate the effectiveness of the RRFB, and too evaluate the RRFB versus a standard side mounted flashing beacon as defined in the CA MUTCD with 8” round beacons that has been modified with high intensity lights and a rapid flash pattern. The experiment will be conducted at one location on Santa Monica Boulevard, a five-lane arterial. The following tasks are proposed.

¹ Transportation Research Board. (2010) *Effects of Yellow Rectangular Rapid-Flashing Beacons on Yielding at Multilane Uncontrolled Crosswalks*, Publication No. FHWA-HRT-10-043, United States Department of Transportation, Turner-Fairbank Highway Research Center, McLean, VA.

Request for Permission to Experiment – Rectangular Rapid Flashing Beacon
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1. Evaluate Existing Setting – Existing traffic facilities and conditions at the crossing location will be documented.
2. Pre-Installation Evaluation – Driver behavior and reactions to pedestrian crossing conditions will be measured with current traffic facilities.
3. Summary of Existing Conditions – Utilizing the setting and data collected in Tasks 1 and 2, an Existing Conditions Memo will be prepared including a description of existing conditions in the corridor and driver compliance with pedestrian crossings. A statistical analysis of crossing results will be performed.
4. Post-Installation RRFB Setting – Following installation of the RRFB, the study location on Santa Monica Boulevard will be reviewed in the field to determine any changed conditions. Any conditions varying from the initial survey will be described including specifications of the RRFB apparatus.
5. RRFB Experiment – Driver behavior to pedestrian crossing conditions will be measured with the installation of the RRFB according to the criteria discussed above. Since the RRFB will be activated via push button, conditions will be collected with the RRFB both activated and off. In addition, residents utilizing the crossing will be observed to determine the percentage of pedestrians who activate the device and the related traffic conditions at the time of activation. These conditions will be surveyed 30-45 days following installation and 90 days following installation.
6. Alternative Flashing Beacon Experiment – Driver behavior to pedestrian crossing conditions will be measured with the installation of the Alternative Flashing Beacon according to the criteria discussed above. Since the RRFB will be activated via push button, conditions will be collected with the RRFB both activated and off. In addition, residents utilizing the crossing will be observed to determine the percentage of pedestrians who activate the device and the related traffic conditions at the time of activation. These conditions will be surveyed 30-45 days following installation and 90 days following installation.
7. Evaluation – A draft technical report will be prepared that documents and compares the effectiveness of the Rapid Rectangular Flashing Beacon (RRFB) installation versus the Alternative Flashing Beacon design in relation to the base conditions. The document will include images of the intersection and data collection conditions as well as graphs, text, and tables summarizing the results of the data.

Request for Permission to Experiment – Rectangular Rapid Flashing Beacon
December 8, 2010
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8. Progress reports – Subsequent progress reports documenting the performance of both alternatives evaluated will be provided following the 30, 45, and 90 day marks.

6. Experiment Schedule

The following schedule for testing is proposed:

Pre-Installation Evaluation	Fall 2010
RRFB Installation	February 2011
RRFB Experiment Period	February – April 2011
Alternative Flashing Beacon Experiment Period	May – July 2011
Evaluation	August – October 2011

We look forward to receiving approval from the CTCDC. Should you have any questions or require any additional information, please contact me directly.

Respectfully,



Sam Morrissey, P.E.
Principal Transportation Engineer
Planning & Community Development Department
City of Santa Monica
sam.morrissey@smgov.net
Tel: 310.458.8955

11-5 Request to Experiment with Bicycle Pavement Marking

Proposal: City of Palo Alto request authorization to conduct an experiment with Bicycle Pavement Marking

Agency Making Request: City of Palo Alto

Sponsor: Jeff Knowles, CTCDC member representing Northern CA Cities

December 16, 2010

Mr. Jeff Knowles
City of Vacaville
650 Merchant Street
Vacaville, CA 95688

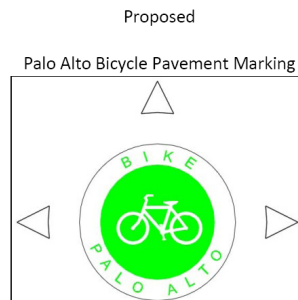
Subject: Palo Alto – Bicycle Pavement Marking
CTCDC Agenda Item Sponsorship

Dear Mr. Knowles,

The City of Palo Alto is seeking sponsorship from the California Traffic Control Devices Committee (CTCDC) for the experimental testing of a new Bicycle Pavement Marking. The marking will be used both in conjunction with MUTCD bicycle destination guide signage and as a stand marking along sporatically signed bike routes to help maneuver bicyclists through public streets.

The City of Palo Alto believes that the proposed Bicycle Pavement Marking will be beneficial to help guide and promote safer bicycle transportation use. The City developed the marking with the assistance of the Palo Alto Bicycle Advisory Commission (PABAC) as part of a pilot bicycle destination guide signage program through Downtown Palo Alto using MUTCD D11-1b/2b/3b. The marking was initially intended to be used with that program to help ensure that bicyclists whom may not be focusing on signage within the sidewalk zone to help make those bicyclists aware of the presence of the destination signage. During presentation of the proposed marking to the California Bicycle Advisory Commission (CBAC) on December 2, 2011 where a recommendation a positive recommendation to the CTCDC to allow experimentation was made, the CBAC members also suggested use of the marking as an independent traffic control device for guiding bicyclists on bike routes where MUTCD standard D11-1 and M5/M6 arrow signage may not already be available. Palo Alto will be expanding its proposed Bicycle Pavement Marking experimentation to use the marking along such areas.

The City anticipates the marking to be well received by our community based off of the markings intuitive design. The marking includes both a combination of both standard MUTCD colors (standard green) and symbols (bicycle legend) and a customizable border legend for use within specific communities or regions. Up to three guide arrows are used with the pavement marking to help denote destinations of interest or bike routes.



To: Mr. Jeff Knowles
Subject: Palo Alto – Bicycle Pavement Marking
CTCDC Agenda Item Sponsorship
Date: December 16, 2010
Page: 2 of 3

To better help you evaluate the City's request, the following responses are provided as requested by the CTCDC:

1. Define the problem that the proposed Palo Alto – Bicycle Pavement Marking is intended to resolve:

The Palo Alto - Bicycle Pavement Marking is intended to help bring awareness to standard bicycle destination guide signage to help better guide bicyclists within communities with which the bicyclists is not familiar. Bicycle destination guide signage such as MUTCD standard D1-1b signs are typically placed within the sidewalk zone outside of the typical cone of vision of a bicyclists whom is focused on the roadway directly ahead of them. The marking will serve as a reminder to bicyclists to look for signage adjacent to the marking or to simply help guide bicyclists along sporadically signed bicycle routes through street where a bicyclists may become easily lost while traveling.

2. Indicate how the proposed Palo Alto – Bicycle Pavement Marking will correct the problem and discuss any other alternatives, either existing traffic control devices that were considered but deemed ineffective.

The only currently approved bicycle marking alternatives include bike lane stencils and Sharrow roadway markings. Both of these devices do not work in conjunction with MUTCD D1-1b/2b/3b type signage to help promote awareness of destinations points of interest or bicycle routes because those traffic control devices are both not applicable in that type of application or their intended design is not compatible.

3. Discuss how the effectiveness of the proposed Palo Alto – Bicycle Pavement Marking will be determined – opinion or actual data.

As part of the experimentation process the City will monitor bicycle activity to determine whether bicyclists whom view the marking with traveling look for adjacent signage and conduct surveys that will be shared within the community. In addition, the City will sign but not mark a route to determine where bicyclists on their own request the marking noting their observance of the marking along other routes. Although designed to be less obvious to motorists because of its size, community input regarding the marking will help to determine its immediate effectiveness and preference.

To: Mr. Jeff Knowles
Subject: Palo Alto – Bicycle Pavement Marking
CTCDC Agenda Item Sponsorship
Date: December 16, 2010
Page: 3 of 3

4. Discuss how additional data will be collected during the experiment phase.

Additional data will be collected in several manners including:

- Website Survey: City will initially make a website survey available to community members whom contact the City regarding the marking and after a several month period to the general public via mailers in utility billings to solicit input regarding the marking use and effectiveness.

The use of a baseline route with similar signage but without the use of the marking was suggested by staff from the Federal Highway Administration (FHWA) whom the City of Palo Alto will be seeking federal experimentation approval.

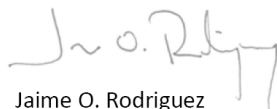
5. Clarify which signs will be used in conjunction with the proposed Palo Alto – Bicycle Pavement Marking.

Attached is a detail prepared by the City of Palo Alto that shows the proposed marking dimensions, other marking design alternatives that were considered but deemed not as appropriate as the preferred design and that highlights the use of the marking in conjunction with MUTCD signage.

As previously noted above, the City has received support to request experimentation with the CTCDC and FHWA by the City Manager's Office, Palo Alto – Bicycle Advisory Commission, and the California Bicycle Advisory Commission. The City is excited about the deployment and looks forward to receiving the support of the CTCDC to begin experimentation in the Spring of 2011.

If you have any questions, please feel free to contact me at (650) 329-2136 or by email at jaime.rodriguez@cityofpaloalto.org.

Sincerely,



Jaime O. Rodriguez
Chief Transportation Official

Attachment

08-20 Final Report on the Experimentation with Flashing Yellow Arrow for Permissive Right Turn Movement

Marin County requests that the Committee adopt Final Report on the experiment. County will develop a language for the CA MUTCD 2010 and bring back to the Committee as an Action Item.



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DEPARTMENT OF PUBLIC WORKS

P. O. Box 4186, San Rafael, CA 94913-4186 • 415/499-6528 • FAX 415/499-3799 • TTY 415/473-3232

December 2, 2010

Farhad Mansourian, RCE
Director

California Traffic Control Devices Committee
Attn: Devinder Singh, CTCDC Executive Secretary
Department of Transportation, Division of Traffic Operations MS 36
P.O. Box 942874,
Sacramento, CA 94274-0001

**RE: Experimentation Final Report
Flashing Yellow Arrow for Permissive Right Turn Movement
Intersection of Sir Francis Drake Blvd and Wolfe Grade
Kentfield, Marin County, CA**

Dear Mr. Singh:

This is the final report for the experimentation of the flashing yellow arrow (FYA) for permissible right turn movement. In our progress report of December 15, 2009, we indicated a significant reduction in the one year collision after installation of the FYA. This final report confirms a significant intersection collision reduction and provides our final observation and conclusions.

PURPOSE

The primary objective of this experiment was to provide a traffic signal control for a permissive right turning lane without impacting the traffic flow rate as well as improving the safety of pedestrians crossing, especially school children. The ability of the FYA indication to improve safety was evaluated with respect to crash experience. Findings of the crash analysis were compared to other variables or modifications such as signal phasing, vehicle queue, and traffic lane configuration approaching the intersection.

BACKGROUND

Accommodating pedestrians and providing a free right turn movement at a signalized intersection provides a challenge to traffic engineers. Most drivers complete the free right turn movement without regard to pedestrian's right of way. As a result of this conflict of movements, successfully accommodating pedestrians and opposing right turning through movement vehicles is critical to the safe and efficient operation of signalized intersections.

The subject intersection (See Figure 1) was operating with a permissible Right-Turn-on-Red (RTOR) movement for both the westbound right turning traffic and the southbound right turning traffic. The RTOR was introduced in the 1970s as a fuel-saving measure and has sometimes had detrimental effects on pedestrians. While the law requires motorists to come to a full stop and yield to cross-street traffic and pedestrians prior to turning right on red, many motorists in this case did not fully comply with the regulations.

F:\Traffic\Traffic Operations\Traffic Signals\SFD & Wolfe Drake CTCDC\2010\SFD&WG Experiment final report.doc

*Experimentation Final Report
December 2, 2010
2 of 4*

Westbound right turning motorists were observed watching for traffic approaching on their left (eastbound motorist making left turn) while not being alert to pedestrians' presence on the crosswalk. In addition, motorists were pulling up into the crosswalk to wait for a gap in traffic, blocking pedestrian crossing movements. In some instances, motorists simply did not come to a full stop.

Traffic engineers had used different types of warning and or regulatory signage to accommodate the free right turn traffic movements at signalized intersections. A previous attempt to prohibit the free right turn on red created a traffic backup on SFDB and was also ignored. To increase the operational efficiency on transportation corridors such as Sir Francis Drake Boulevard, County of Marin traffic engineers decided to employ the flashing yellow arrow (FYA).

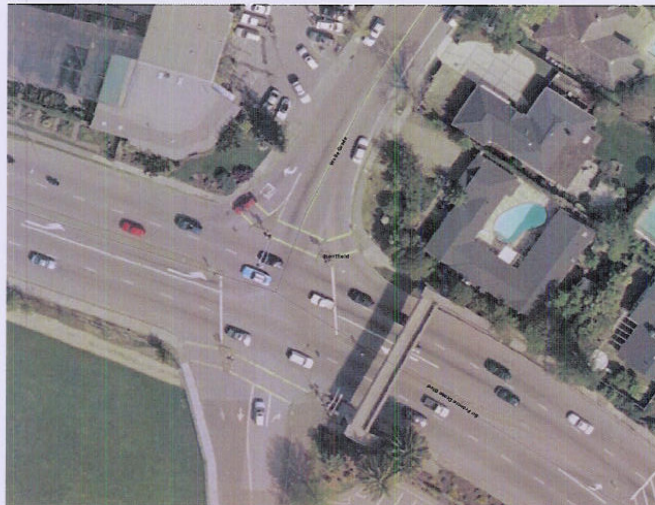


Figure 1

DRIVER BEHAVIOR

One of the most effective means to measure the FYA was by conducting a field observation of driver behavior, and drivers' understanding of the FYA. The field observations of driver's behavior, making a right-turn vs. conflicting with pedestrians in the crosswalk pedestrians or the opposing left turning vehicles was also observed. The flashing yellow arrow had a high level of driver comprehension. Drivers were observed and have shown a good observation of the FYA regulation.

COLLISION ANALYSIS

Data essential for evaluation included 'before' and 'after' collision data and supporting information about the intersection such as traffic volume (ideally turning movement counts), signal timing and the geometry. A minimum of three years of crash data were obtained for the time period prior to implementation of the FYA indication. Crash data available 'after' implementation were obtained from the date of installation to the most recent date for which

*Experimentation Final Report**December 2, 2010**3 of 4*

data were available (See Table 1). When available, actual crash reports were acquired to obtain all information known about the reported crashes. Data related to signal timing of the intersection and pertinent operational data 'before' and 'after' the FYA installation were reviewed. Impact of changes in signal timing parameters for the overall timing and phasing was evaluated.

The collision types were summarized in the experiment using the following classifications:

Side-Swipe: Collisions that included side-to-side impact between two vehicles. This type of accident usually occurred between the westbound left turning vehicles and the permissive right turn vehicles.

Rear-End: Collision occurring primarily between the front of one vehicle and the rear of another. This type of collision occurred between the permissive right turning vehicles before crossing the north side crosswalk at Wolfe Grade. This usually involves a pedestrian in such a way that the leading vehicle stopping suddenly to avoid hitting the pedestrian in the crosswalk and the following vehicle could not stop in time and contacting/ colliding with the leading vehicle.

Table 1**Sir Francis Drake Blvd and Wolfe Grade**

<i>Before</i> Installation/Collision Period 1/1/2001 – 9/30/2007		<i>After</i> Installation/Collision Period 5/1/2008 – 3/30/2009	
Date	Collision Type	Date	Collision Type
9/6/2001	Rear-end	5/10/2008	Rear-end
6/27/2003	Rear-end	3/18/2009	Rear-end
7/20/2003	Sideswipe		
4/6/2005	Broadside		
9/5/2007	Rear-end		

INSTALLATION & OPERATIONAL CONSIDERATIONS

The installation of the FYA indications has some challenges for the 170E controller running BITans 233. The installation required the writing of new command code, installation of additional logic boards, and the configuration of numerous jumpers within the controller cabinet. The newer controller needed a program for an FYA interval. The addition of external logic was necessary, because the conflict monitors routinely (once a week) indicated a conflict and needed to be reset.

CONCLUSION

The experiment implemented a FYA signal indication in an attempt to better communicate to the right-turning driver that they must yield to pedestrian traffic before proceeding. Before the FYA implementation, it was noted that drivers did not obey the pedestrian right-of-way and crashes between vehicles with fixed objects were noted. The result, as demonstrated by a reduction in collisions, indicated that the installation of the FYA to control the permissive right turning lane provided a safety improvement when added to signal phasing operations. Safety

Experimentation Final Report

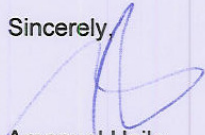
December 2, 2010

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is now improved at the intersection, and the average annual frequency of total crashes has been reduced.

The experimental project undertaken by the County of Marin showed that the FYA signals improve pedestrian's safety and moves traffic efficiently. The county encourages the California Traffic Device Committee to recommend the adoption of FYA signal to the California of Transportation as an official traffic control device.

Sincerely,



Amanuel Haile
Assistant Engineer

Attachments:

CTCDC Status of experiment progress report form
Photo of intersection

c: Farhad Mansourian

CTCDC STATUS OF EXPERIMENT**Date:** December 2, 2010**Item:** 08-20**Experiment:**

Experimentation Final Report, Flashing Yellow Arrow for Permissive Right Turn Movement for the Intersection of Sir Francis Drake Blvd and Wolfe Grade Kentfield, Marin County, CA

Sponsor: Farhad Mansourian, County of Marin**Supporting Agency & Contact :** Amanuel Haile, County of Marin**Next Appearance Before the CTCDC** February 2, 2011

Milestones: Application for Experimentation: May 6, 2008
Progress Report I: December 15, 2009
Progress Report II: June 6, 2010
Final Report: December 2, 2010

Status: The experiment implemented a FYA signal indication in an attempt to better communicate to the right-turning driver that they must yield to pedestrian traffic before proceeding. Before the FYA implementation, it was noted that drivers did not obey the pedestrian right-of-way and crashes between vehicles with fixed objects were noted. The result, as demonstrated by a reduction in collisions, indicated that the installation of the FYA to control the permissive right turning lane provided a safety improvement when added to signal phasing operations. Safety is now improved at the intersection, and the average annual frequency of total crashes has been reduced. The experimental project undertaken by the County of Marin showed that the FYA signals improve pedestrian's safety and moves traffic efficiently. The county encourages the California Traffic Device Committee to recommend the adoption of FYA signal to the California of Transportation as an official traffic control device.

Applicant's Signature 

Applicant's Name: Amanuel Haile, County of Marin**Address:** P.O.Box 4186, San Rafael, CA 94913-4186**Phone:** 415-499-7137 **FAX:** 415-499-7847



Sir Francis Drake Blvd and Wolfe Grade

Collision Period: 5/1/2008 to 3/30/2009

The 2 collisions that are considered for the experiment are located along Wolfe Grade with

05/10/08 Rear-End

03/18/09 Rear-End

6. Information Item

10-11 Status of speed limit procedures changes in July 2009

7 Next Meeting

8 Adjourn